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THE CANADIAN NORTH

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THE NEW NORTH



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Ottawa, Canada



Steel and concrete bridge on Alaska Highway, constructed over Teslin River at Mile 837.
U.S. Army photo

Yellowknife Bay from Yellowknife Settlement, showing commercial oil storage on Jolliffe Island

The New North*

by CHARLES CAMSELL

THOSE OF US whose mental picture of the Western Hemisphere is based on the Mercator projection maps which were in common use a generation ago will remember Canada sitting like a great red keystone on the top of the continent. That, of course, is a distorted picture, but even after the distortion has been corrected it remains a fact that Canada is one of the greatest land masses in the world under one sovereignty, and occupies a geographical position of rapidly-growing importance on the crossroads of the great intercontinental air routes of the future.

Any discussion of Canada must take into consideration the vast extent of that country. While it is a northern land, reaching into and including the most northern land surfaces adjacent to the North Pole, it also extends southwards far below the British Isles to latitude 41° 41′, which is slightly south of Rome in Europe and slightly south of the northern boundary of California in America. The area of this huge country is 3,695,189 square miles, which is equal to a little more than sixty-three times the area of England and Wales, and is only a little less than that of the whole continent of Europe.

The southern parts of Canada have been under development for many years, and are well known for what they have achieved in the fields of agriculture, mining, forest production, hydro-electric power, and manufactures. It is with the less known northern areas that this paper is principally concerned.

The Confederation consists of nine provinces, which form a broad belt across almost the centre of the North American continent, with its northern edge, for the most part, on the 60th parallel. North of that parallel lie the Yukon Territory, 207,076 square miles, and the Northwest Territories, 1,309,682 square miles, a total of 1,516,758 square miles. For practical purposes my discussion must also include certain areas in the northern parts of some of the provinces, particularly Alberta and British Columbia. This territory, administered until 1869 by the Hudson's Bay Company, was until that time, and for many years later, valued mainly for its production of fur, although early explorers had also given some glimpse into the physical resources of the land. However, it may be said that except for the discovery and development of mineral resources—gold in the Yukon (Klondike) in 1896, oil at Norman (Wells) in 1920, and gold at Yellowknife and radium at Great Bear Lake within the last two decades—the northwest has lain dormant, contributing to the economy of Canada mainly through the fur trade.

In the very northwestern corner of the continent lies Alaska, a possession of the United States, with its area of 586,400 square miles, including the "panhandle" which stretches part of the way along the northwestern side of British Columbia. The fact that this area belongs to the United States has had a significance in the war which could not well be foreseen, and promises to be an important factor in northwestern development after the return of peace. Now the northwest has burst into new life, and Canadians are beginning to realize that here is a part of their national heritage which may have vast potentialities, and which may offer to those of British stock possessed of the pioneer spirit an outlet for their energies when this war is over.

The outbreak of war with Japan gave a new interest and importance to the areas bordering on the North Pacific. This interest, however, relates not only to the coastal and adjoining areas, but is reflected in the

*This article, reprinted from the June, 1945, issue of the Journal of the Royal Society of Arts, London, England, was awarded a special prize by the Society. In view of developments which have taken place since the article was prepared, some up-to-date information has been added, in brackets.

Photographs from the Bureau of Northwest Territories and Yukon Affairs, Department of Mines and Resources, Ottawa, unless otherwise credited.

Cover photo:—Samples of gold ore undergoing assay at Yellowknife, N. W. T.

N.F.B. photo



Fort Smith from the air, looking northwest.

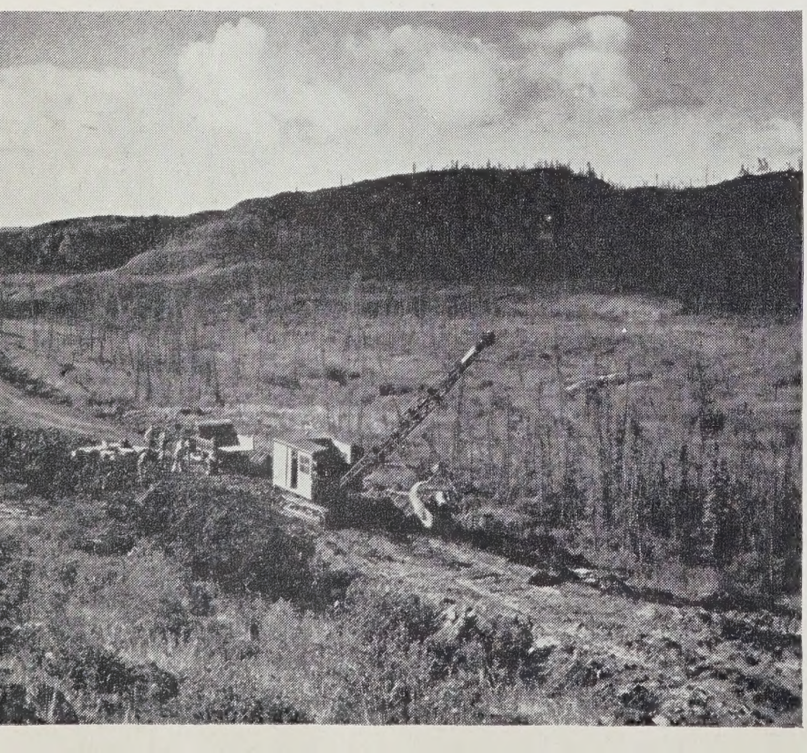


Fort Norman, looking

great interior. This part of the North American continent, long so little known or understood, has acquired in the public mind a strategic importance which was not appreciated before Pearl Harbour. Similarly, the far eastern parts of the area have undergone a military development which seems sure to have its commercial effects after the war. The whole region has therefore assumed in the minds of forward-looking people an economic importance due to better understanding of its potentialities and to the new lines of communication which have been developed into it and through it.

Alaska and Yukon Territory before the war were practically inaccessible except by water along the Pacific coast, and hence were very difficult to reach and, in case of necessity, to defend. While there was some agitation among west coast people before the war for an overland connection between Alaska and the rest of the continent, no definite steps, except preliminary surveys, were taken either by Canada or the United States toward the building of a highway. Public interest in such a project was restricted almost entirely to Alaska and the Yukon, the northwestern states, and British Columbia. As for the inside of this northern region, travel was confined, in Canadian territory at least, to the waterways, chief of which were the Mackenzie and Yukon Rivers, as it had been for a century and more.

As aeroplane travel became more practicable and popular, however, routes were developed from Edmonton northward into the Mackenzie Basin and were used largely by prospecting and mining companies. Only two or three years before the war a passenger service was opened northwest from Edmonton, in Alberta, to Whitehorse and Dawson, in Yukon Territory, cutting diagonally across the region now being opened up. After the outbreak of war the Government of Canada further developed and improved this particular route to the Yukon by the building of a line of airports at Fort St. John, Fort Nelson, Watson Lake and Whitehorse, and so the present airway, known as the Northwest Staging Route, came into being. This was the first route in the whole



Dragline excavator at work on road connecting shafts on Giant Yellowknife Gold Mines Limited property. N.F.B. photo



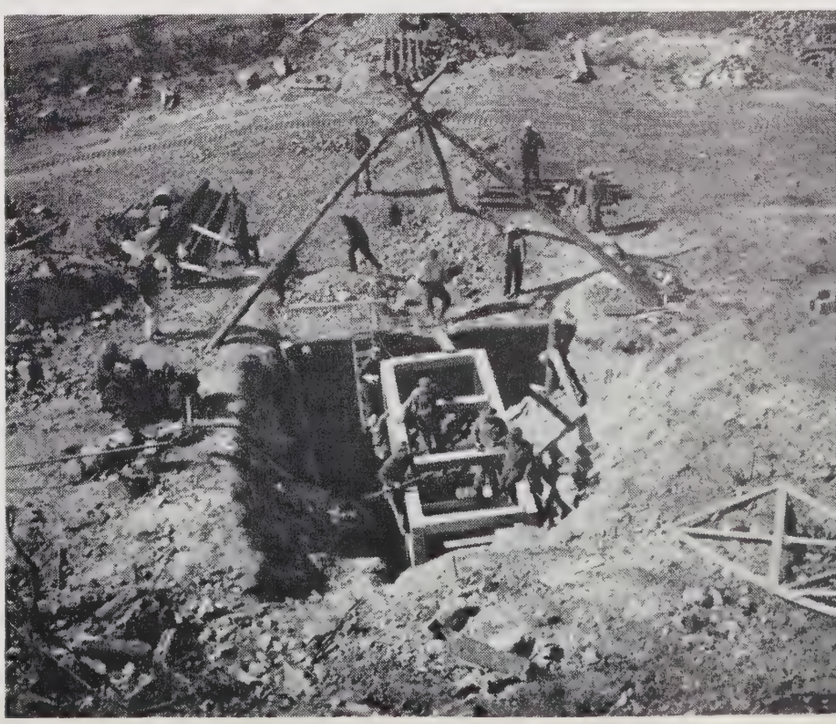
ock in background.



The Town of Dawson on Yukon River, looking northwest.
Photo by H. Holman

of our north country over which land planes could be used. It was strictly a Canadian undertaking and, as indicated by the Hon. C. D. Howe, Minister of Munitions and Supply (now Minister of Reconstruction), will be controlled by Canada. I make that observation in passing, as the close interlocking of United States and Canadian interests in the defence of North America have called for equally close association in their military effort, in which the strict limitations of national sovereignty have not been insisted upon. This co-operation, however, is based upon and made possible by assurance and complete return to the original status.

It was in December, 1941, that the treacherous attack on Pearl Harbour suddenly flung the searchlight upon Northwestern America. This attack was followed by the occupation of Kiska and Attu by Japan, and both Canada and the United States suddenly awoke to the threat to their sovereignty in the North Pacific region by our Japanese enemies. It was obvious at once that the airways would have to be secured and airports serviced by an adequate ground transportation route. An agreement was consequently made between Canada and the United States for the building by the United States Corps of Engineers of a military road extending from the end of the railway at Dawson Creek, British Columbia, to Fairbanks, Alaska, now known as the Alaska Military Highway. Construction was commenced in March, 1942, and eight months later the road was officially opened for traffic. This highway cuts through more than 1,200 miles of the Canadian wilderness, and its building was one of the engineering achievements of the war. At the same time other undertakings such as the Canol Project, which includes oil developments in the Lower Mackenzie, a pipeline west to Whitehorse, landing fields between Edmonton and Norman Wells, and a number of winter roads were started. These projects have now practically reached completion. (Oil production at Norman Wells on Canol account was discontinued on orders of the United States Government in March, 1945, and the refinery at Whitehorse closed in April, 1945.



Beginning a three-compartment shaft at Giant Yellowknife property. N.F.B. photo



"Con" Camp buildings from Yellowknife Bay

Disposition of surplus assets and supplies is now receiving attention. Control and maintenance of the Alaska Highway was assumed by Canadian authorities on April 1, 1946, and the possibility of the route being opened to the general public, after adequate tourist accommodations along the route have been provided, is being studied.)

Developments in the north, including the provision of all these transportation facilities and the resources that become available through them, have thrown a searchlight of public interest on the region, so that people have begun to ask "What is this country like, and what about the use of these transportation facilities in its economic development after the war ?"

Another question among air-minded people arises from a study of the map of the Northern Hemisphere. It reveals that the shortest airway from the centre of the North American Continent to Japan, China, Siberia and other parts of Asia is directly through this region. What influence will the development of such an airway have upon the territory it traverses ?

These questions demand an answer. That answer was being sought under the auspices of Joint Economic Committees organized by Canada and the United States, which decided to sponsor a project involving a systematic study by the two countries of all the problems involved. This undertaking has been carried out by groups in Canada and the United States collaborating with each other. The Canadian group included members of interested federal departments of government working in co-operation with the Governments of Alberta and British Columbia.

The territory which came under this study has an area of approximately 1,360,000 square miles, more than half of which lies in Canada. It is about the size of Europe excluding European Russia. It is inhabited by less than 100,000 people, of whom the greater number is in Alaska. Boundaries of the area are not clearly defined except on the north and west, where lie the Arctic and Pacific Oceans. The southern boundary of the area is about latitude 53°N. The eastern boundary follows the broad valleys of the Athabaska, Slave and Mackenzie Rivers. Within these boundaries lies some of Canada's finest virgin territory, more varied in its resources than most of the unsettled country to the east of it, and, because most of it comes within the influence of warm



Yukon River with its many islands
Geological Survey of Canada photo

winds from the Pacific, less rigorous in its climate.

A few words as to the climate may be in order at this point. Naturally, in so large an area there are great variations of climate and I can deal with the subject only in general terms. Low winter temperatures are carried well up the Mackenzie Valley and the intervening country on the west side of Hudson Bay to the Churchill and Nelson Rivers. Very low temperatures sometimes occur in these areas but the mean temperature is about 30° warmer than that portion of Siberia with the same relative situation. Long periods of steady cold are of very rare occurrence in this northwestern region. After the passage of a cold wave the wind shifts into a westerly or southerly quarter and the region is rapidly invaded by air of Pacific or southwestern origin with rising temperatures. In the Peace River country and northern British Columbia the winter is milder under the influence of the circulation from the Pacific and through the mountain valleys from the south. In spite of their higher latitude these areas are warmer than some mid-continent regions considerably south of them. This is especially true of the northern British Columbia coast where cloud and rain, rather than low temperatures, are the characteristics of winter. In early May the temperature begins to rise quickly in the southerly parts of this region but at the Arctic Circle the rapid climb begins somewhat later. By the beginning of July the country along the Mackenzie Valley and the basin drained by its tributaries reaches a mean temperature of about 60°. Temperatures exceeding 90° or even 95° sometimes occur in the short summer of the northwest. The long period of sunlight, with scarcely any darkness, contributes to the extremely rapid growth of native grasses and plants. The experimental farms at Fort Vermilion and at Beaverledge grow wheat successfully. The entire area except for the northern Pacific coast is one of low precipitation, with an average of from five to ten inches of rain annually. The snowfall is equivalent to an additional five to seven inches of water. Of course, this is a country of low evaporation, so that these precipitations are more ample than they would be at southern latitudes. On the whole the climate, although rigorous, is quite livable, and throughout the area has not been a serious barrier to permanent settlement.

The Canadian part of the North Pacific region, which is all I propose to deal with in any detail, includes Yukon Territory, Mackenzie District of the Northwest Territories, northern British Columbia, and northern Alberta. The major physical features of the region trend northwest and southeast. On the east of the area, and outside of it, is an extension of the Precambrian Shield, a rocky country of numberless lakes, rolling hills and, as you go north, little or no covering of soil or forests. Bordering this on the west is the northward extension of the Great Plains region occupied by the northward-flowing Mackenzie River and its tributaries, the Athabaska, Slave, Peace, Liard, Peel, and many others, and bearing on its surface such great lakes as Athabaska, Great Slave and Great Bear. This region is fairly uniform in contour. Its surface is broken only by isolated hills or



refinery and age tanks at rman Wells, V.T.

ranges of low mountains, and is covered by forest to the shores of the Arctic. A great deal of the country back from the rivers is the typical northern muskeg. While its principal economic value is and has been as a fur-bearing region, it offers in certain areas, notably the Peace River region, considerable opportunity for agricultural development. Its greatest potentialities in mineral resources are in oil. The Norman oil field lies in this area.

West of this, and covering the greater part of the area, is the Cordilleran region. This great physiographic unit is essentially mountainous with high plateaux separating the mountain units. It is more diversified than the other two in its physical characteristics, less uniform in the climatic conditions of temperature and precipitation, and more varied in its natural resources of forests, soils, minerals and wild life. Much of it extends above the timber line; some areas in the coast ranges are snow-covered throughout the year. A strip along the Arctic coast is tundra. Its rivers, Yukon in particular, follow the main northwest and southeast trends. Some of them, however, such as the Peace, Liard, Skeena and Stikine, cut across these trends and provide lines of access into the interior both from the east and from the west. Through this great region, before the coming of the aeroplane or the building of the highway, the principal lines of travel were along its rivers, mainly the Mackenzie and the Yukon, first of all by canoe and York boat, and during the last fifty years by steamboat. Today the aeroplane is the dominant method of transport for passengers.

Against this brief outline of the physical background, let me sketch, as far as is known, some of the resources of the region, and the possibilities of development that are latent therein. The first objective we have had in our study of this region is to deter-

Erecting prefabricated buildings on new townsite at Yellowknife. N.F.B. photo





Rough country north of June Lake, east of Mackenzie District-Yukon boundary

R.C.A.F. photo

mine what population we may expect it to support. The answer to that question is contained in another question, viz.: What industries are likely to be developed in it? This will depend upon its basic resources, on its lands, its minerals, its forests, and its wild life, its power potentialities and its transportation possibilities. These are the subjects to which we are giving our first attention and our first problem, therefore, is to determine what are the basic resources of the region.

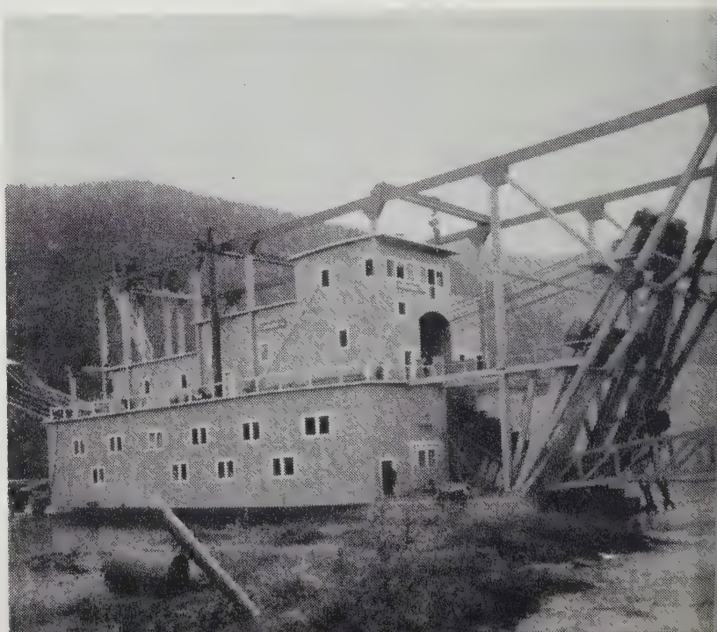
Much has already been done in appraisal of these resources over the last fifty or sixty years but very much more is still to be done, as a great deal of the country is still a terra incognita. During the past two seasons (1943 and 1944) we made our biggest effort so far, and this effort was largely concentrated along the line of the highway and the pipeline, though much was done on oil investigations on the Athabaska and Mackenzie Rivers. Geological parties covered the highway from Dawson Creek to Whitehorse, and in 1944 extended their activities northward and eastward; soil and grazing specialists from the Department of Agriculture traversed the whole highway from Dawson Creek to Kluane Lake and on to Dawson with a view to appraising its agricultural possibilities. This year (1945) similar parties are in the Mackenzie Valley. We also had biological parties, botanical parties, forestry parties, and one party making a report on its scenic attractions. Fish experts covered Great Slave Lake and Mackenzie River. We also had water power engineers and others studying transportation problems. The results of all these investigations are now being analysed. (Geological, agricultural, topo-

graphical, hydrographic, water-power, and fish surveys were continued in 1945 and 1946. An experimental sub-station was opened by the Department of Agriculture on the Alaska Highway about 100 miles west of Whitehorse in 1945, and a start was made on a similar project at Fort Simpson, in Mackenzie District in 1946. A commercial fishery was opened on Great Slave Lake in 1945 and continued in 1946. During 1945 and 1946 considerable effort was devoted to the search for uranium, the element which has played such an important part in the development of atomic power. A new hydro-electric development was undertaken in the Yellowknife mining district in 1946.)

Of the basic resources let us take first of all its minerals because, after all, mining has so often proved in other parts of Canada to be the spearhead of economic development, and no doubt it will prove to be so here. The most notable developments in mining so far in the north country have been in lode gold at Yellowknife, pitchblende at Great Bear Lake, oil at Norman, placer gold in Cariboo, Omineca, Atlin and Klondike, mercury, copper, silver, tungsten and coal in the mountains. These, however, do not exhaust the possibilities of mineral development by any means. A variety of rare minerals was discovered in the Precambrian area last summer, and throughout the mountains generally there are great areas where prospecting for metallic minerals may be carried on with promise of success.

In my opinion, however, the greatest promise of mineral development lies in metallics in the Precambrian, and in oil along the eastern edge of the mountains and on the lower Mackenzie. The bituminous sands of the Athabaska field are well known, and are now being given a thorough test at MacMurray. (During the war years progress was made in developing the treatment of the sands for the economical extraction of bitumen. During the same period, considerable drilling was carried on to locate deposits of sand rich in bitumen.) The petroleum resources offer the greatest opportunities for early development and for increase of population. One of our expert investigators reports on this subject: "Here, then, we have the essentials for potential oilfields covering an area of over one thousand miles in length. This is probably the largest comparatively unexplored potential petroleum region in North America, and surface evidence of oil in the form of seepage occurs in several places." It was these oil resources which led the United States, with the consent of the Canadian Government, to build the Canol





Above:—Aerial view of mine and mill of Eldorado Mining and Refining, Labine Point, Great Bear Lake N.F.B. photo

Right:—A modern gold dredge in the Klondike District, Yukon Territory

Right centre:—Grain plot at Dominion Agricultural Substation, Mile 1019, Alaska Highway, Yukon Territory

Extreme right:—Processing barges used by a commercial fishery at Gros Cap on Great Slave Lake.



Unloading lumber at dock, Yellowknife Settlement. N.F.B. photo

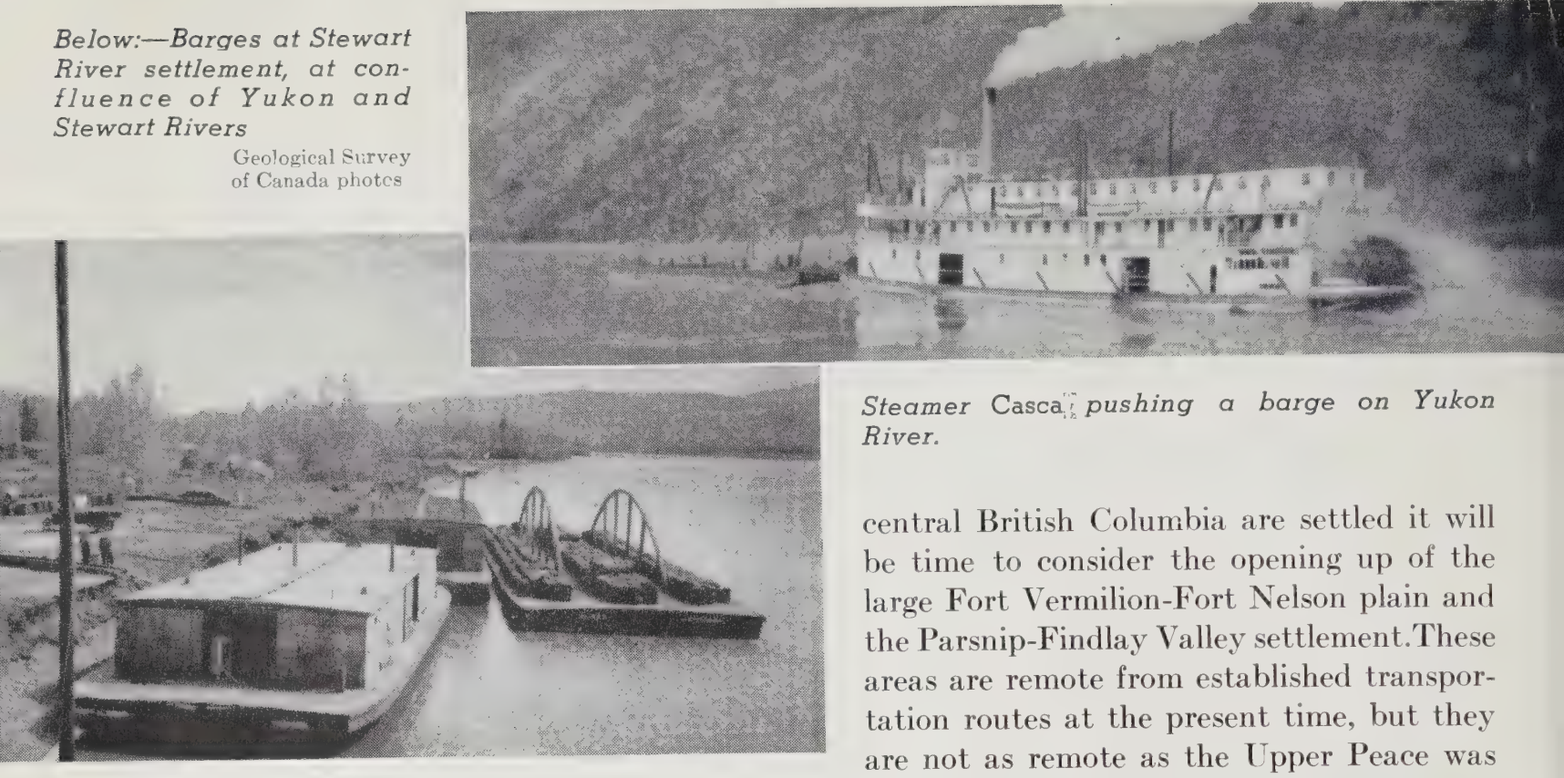
pipeline from Norman Wells to Whitehorse, a distance of 577 miles, so that gasoline might be available for motor use on the Alaska Highway and for aeroplane use in the protection of Alaska and the Pacific Coast. (Although operations connected with the Canol project were terminated in March, 1945, geological reconnaissance surveys and exploratory drilling in the Mackenzie District have since been carried on by private enterprise.)

The agricultural possibilities of the area are substantial, but he would be a rash speaker who would attempt to define them in precise terms. More than soil and climate enter into agriculture; conditions change, and conclusions based upon the facts of the 1940's may be inaccurate in the 1960's, or before. What I mean is this: there was a time when the agricultural possibilities of Canada's prairie region, stretching from the Red River to the Rocky Mountains, were seriously questioned. Early frosts in many areas, drought in others, seemed immovable obstacles to a permanent and prosperous agriculture. But new varieties of grain, developed mainly through the scientific efforts of Canada's Department of Agriculture, together with changing climatic conditions due to settlement, overcame the menace of frost, and new methods of agriculture have mitigated the damage from drought except in most severe seasons and in the areas of lightest rainfall. Today that prairie country, once regarded as a doubtful agricultural asset, is recognized as the "bread basket of the Empire" and one of the greatest food-producing areas in the world. While one must be guarded in one's predictions about any new country, the future is just as likely to confound one for pessimism as for optimism. Some things, however, we know. Extensive



Below:—Barges at Stewart River settlement, at confluence of Yukon and Stewart Rivers

Geological Survey of Canada photos



Steamer Casca pushing a barge on Yukon River.

research has already been made by Canada's Department of Agriculture, and perhaps I cannot do better than quote some conclusions arrived at by Dr. E. S. Archibald, Director of the Experimental Farm Service of Canada:

"Present information indicates that there may be about 15,000,000 acres of arable virgin land in the area defined in this paper as northwestern Canada. One-third of this area is serviced by existing railroads, while the remainder is largely inaccessible at the present time. These figures may be considered as conservative by some, as they do not include large areas of the poorer types of grey wooded soils.

"In time most of the better lands in northwestern Canada will be farmed. Their development, however, will be slow as compared with the opening up of the prairies in the early years of this country. The wooded nature of these lands and their distance from railways will prevent any rapid development. This is not to be deplored, as it will permit an orderly settlement, based on soil survey and other pertinent information, to take place.

"Immediate future development should be confined to those areas at present serviced by railways and to locations where a certain amount of agriculture would assist materially in the development of other natural resources. After the good vacant lands in the Upper Peace and the railways belt of central British Columbia are settled it will be time to consider the opening up of the large Fort Vermilion-Fort Nelson plain and the Parsnip-Findlay Valley settlement. These areas are remote from established transportation routes at the present time, but they are not as remote as the Upper Peace was some thirty years ago.

"Some soil surveys have been conducted in the region, and it is hoped that after the war the present joint Dominion-Provincial soil surveys in Alberta and British Columbia can be expanded to a sufficient extent to be able to undertake vigorous programs in the northern areas of these provinces."

In agriculture, therefore, the greatest expansion in the foreseeable future will undoubtedly take place in the Peace River basin, although smaller areas of suitable agricultural land have been noted by investigators at Fort Nelson, in north central British Columbia and (in the Takhini-Dezedeash Valleys) near Champagne, west of Whitehorse. Elsewhere small-scale farming operations have been carried on at many points along the main valleys even to the edge of the Arctic Circle; enough, at least, to serve many of the local needs. As population increases, dependent upon other industries, no doubt this type of agriculture will be proportionately expanded.

The forest resources of the Canadian North and West are scattered over an immense area, and vary greatly according to latitude, altitude and climatic conditions. There is a heavy forest cover in the coast area, estimated to be capable of producing 240,000,000 board feet annually. This area is at present being drawn upon heavily for war purposes. It is estimated that the forests of the interior of northern British Columbia



The waterfront at Yellowknife Settlement

Below:—The Alaska Highway. Mile 1210, not far from Yukon-Alaska Boundary.



have an annual growth of 1,250,000,000 board feet, but only about one-fifth of this is at present accessible. There are also substantial forest resources along the Alaska Highway, including some scattered stands in the Yukon Territory. Patches of merchantable spruce appear to occur generally along all the larger rivers in Mackenzie District, but they rarely occur with sufficient frequency to constitute any large reserve. There is, however, much small timber very valuable to campers and prospectors, and as a habitat for game and fur-bearing animals.

This brings me to a mention of the fur trade, which is the north's oldest industry and has been carried on for 150 years. It is the policy of the Government to protect the game as much as possible for the subsistence of the native population, and extensive game preserves have been established for that purpose. There is no doubt that the game resources of the country, which include game fish, can be maintained against any reasonable drain, and can also be developed as an important attraction to sportsmen. (A recent development was the establishment in 1946 of a forest and game protection service in Mackenzie District of the Northwest Territories, with headquarters at Fort Smith.)

The country is well supplied with resources of coal, oil and running water for the production of power. As industrialization progresses, no doubt these resources will be developed.

Undoubtedly there will be many who will want to go into this area when the war is over, whether to engage in farming, prospecting, or the development of some of the other resources which I have outlined. You may therefore expect me to make some predictions as to the population which can be carried by the Canadian section of the great northwest. Here one enters the realm of speculation, though an appraisal of the natural resources of the region gives some basis for an opinion on its population possibilities. The Precambrian country east of



A lake in east central Yukon
Photo by George Black



Aircraft are used extensively in prospecting near Yellowknife. N.F.B. photo

the Mackenzie Valley never can be expected to maintain a large permanent population unless there are large mineral developments in that area. Exhaustion of mineral resources elsewhere, or increased demands for minerals, should lead to widespread exploration and discoveries in the north, but it is impossible at this time to predict the extent of developments arising out of such discoveries. One can, however, visualize centres of population throughout this region based upon mineral development. The section west of the Mackenzie River, including the immediate river area itself, offers somewhat greater assurances of sustained population. The soil is better, the climate is more moderate, there is a heavier forest cover, but most important of all, here lie the greatest possibilities of oil development that we have in Canada. In the southern portion of this area are also the greatest opportunities of agricultural expansion.

Of a different type are the industries that may support a population on the Pacific watershed. Here we have a climate more mild than that in eastern parts of the continent many degrees farther south, supported by an ample rainfall. Growth is relatively heavy and rapid, and such agricultural areas as exist are capable of supporting a somewhat concentrated population. Here, too, are definite industrial possibilities—lumbering and the manufacture of paper, for example, and the processing of the valuable crops of the sea. Here also are great possibilities for metallic mineral and power developments. It is reasonable to hope that in process of time this area will support a density of population comparable to that now found in Norway.

On the whole, I think it would be optimistic to look for a great rush of settlement into Canada's Far North, as seems to be anticipated in some quarters. Comparisons with an area like Siberia, for example, are likely to be misleading. Although Russia cannot be described as an over-populated country, the density of population there is about six times what it is in Canada, and other conditions, such as the opening of the Arctic sea route from east to west, which do not exist here, have tended to press the fringe of settlement farther north. Certainly Canada's North will support a larger population than at present, and in many localities, a very much larger population, but I think it safe to say that the density of permanent population north of the fifty-fifth parallel is not likely to be as great as that farther south. My opinion on this matter is influenced by our experience with other roads pushing out through our virgin territory. Those most successful, such as the Temiskaming and Northern Ontario Railway, had the benefit of traversing mineral-bearing territory, and traffic associated with the mines was the principal source of revenue. Farming developed later, wherever there was suitable land. Those roads or parts of roads which did not tap the mining areas were not so successful or were much slower in developing population.

The conclusion that I arrive at, therefore,

is that in the opening up of this new Northwest the mineral resources are of prime importance, and will constitute the spearhead of development. Agriculture and other primary industries will follow wherever conditions are favourable.

I have been speaking of permanent population, but there is another aspect, in which the picture may differ. That is with respect to *temporary* populations; I mean the population which moves in for a few days or a few weeks to see the scenery and enjoy the freedoms and contacts of the North. Few countries have such attractions to offer, and few have such unmeasured possibilities of development along that line. The Alaska Military Highway, and other trunk channels which may be driven through the wilderness, will, in time, become arteries for motorized travel, and the great water routes of the Mackenzie River provide other means of entry, so that tourists and those of adventurous mind may respond to the insistent lure of the North. The air routes also will bring many people in response to this lure. For there *is* such a lure. Explain it how you will, men—and also women—who have once tasted the life of the north never seem to be fully satisfied elsewhere. There is something inherent in the human heart and the human soul which responds to the appeal of the Wilderness, and which no other appeal can satisfy. Here, then, lies the greatest unspoiled recreation land on the continent today. With the return of peace, tourist travel, either along the highway or by air, or along its great rivers, will draw many people to Canada, and the great Northwest will have its share. This stream, however, as I see it, will not reach full flood immediately the war is over because the highway that will be handed over to the Canadian Government will be a military road, and not a tourist highway, and the other routes need developing for tourism. Much improvement in the road will be necessary before it becomes a highway, such as tourists have been accustomed to on this continent and a little time must elapse before provision can be made for fuel supplies and accommodation. (See previous note concerning the control, maintenance and use of the Alaska Highway.)

Those of you who have been patient enough to bear with me thus far must be aware that I am dealing with an immense territory concerning which in many respects information at present available is by no means final. We are seeking, and obtaining, more information every year; I might almost say, every month. Field investigations, conducted mainly by the Department of Mines and Resources—which include forestry and wild life—are designed to uncover and establish a factual picture of the whole country. Extensive mapping work, involving aerial photography, is being carried on. Many Canadian government experts are in the field at this moment, assembling the information which will take the guess-work and much of the hazard out of the future development of this country. Just as the map of Canada has for a century been unrolled westward, so now it is northward that "the tide of Empire takes its way". The same racial stock which has carried the flag around the world will also carry it to the farthest north, and we may be sure that they and their sons and daughters will write a record of achievement not unworthy of the race from which they sprang.



Looking upstream from site of hydro power development on Snare River, N. W. T.



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Recent Developments in the Canadian North



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FOREWORD

This article is based on the Alumni Lecture delivered at McMaster University on May 14, 1949. It was subsequently printed in this form in the Canadian Geographical Journal.

In view of the number of requests for copies of the lecture these reprints have been made available.

The lecture is intended to present a broad picture of development in the Canadian North and the basic factors governing that development. It would be impossible in brief space to present a detailed picture of the various aspects of such a far-flung area, and no attempt has been made to do so.

The detailed factual background is to be found in a number of Departmental publications, a list of which is given at the end of the text. Copies of these, as of the present lecture, may be obtained by writing to the Editorial and Information Division, Department of Mines and Resources, Ottawa, Canada.



An R.C.A.F. Canso aircraft beached at Cambridge Bay, Victoria Island.

Recent Developments in the Canadian North

by H. L. KEENLEYSIDE

FOR MANY YEARS modern interest in polar areas was largely concentrated on the frozen regions of the Southern Hemisphere. The international race for the South Pole, first reached by Amundsen, the dramatic exploits and death of Sir Robert Scott and the quiet heroes who accompanied him, the development of commercial whaling in Antarctic seas, the establishment of Little America and the introduction of aircraft to the polar continent by Admiral Byrd, all attracted attention to the bottom of the world.

But there has been a sudden switch of interest. Today relatively little is heard of the Antarctic while never, even in the early days of the search for a northwest passage to the riches of the Indies, has there been so great a concentration on the problems of the north polar regions.

It is not difficult to identify the reasons for this change. Canadians and other northern people are being forced by the bitter facts of international life to free their minds from the shackles imposed by the flat distortions of the Mercator map, and to realize that the political, economic and military powers of the modern world are grouped about the Arctic Sea. Included among them are those two great national concentrations of strength and concept, the United States of America and the Union of Socialist Soviet Republics.

Despite the bitter lessons of two world wars some nations are again denying the



Sled runners are given a coating of ice for easy travel over the snow.





ARCTIC BAY, NORTHERN BAFFIN ISLAND

The panorama of the settlement (above) shows the buildings of the Department of Transport radio station, Hudson's Bay Company trading post, and Roman Catholic Mission. In the background is King George V Mountain.

Bottom left:—Hudson's Bay Company residence at Arctic Bay.

Right:—An Eskimo family at their encampment near Arctic Bay.

truth—though without altering the fact—that humanity is inextricably united in One World. This heresy has been revived at the very time that science has placed in our hands an unexampled power of destruction. But whether the nations choose peace or war, whether we exchange trade or bombs, whether we compete in destruction or co-operate in the extension of human knowledge and the control of nature—including that dubious natural character man himself—the basic international problems of this generation will be faced, as for the most part they have been created, by the peoples of the North.

What the Aegean Sea was to classical antiquity, what the Mediterranean was to the Roman world, what the Atlantic Ocean was to the expanding Europe of Renaissance days, the Arctic Ocean is becoming to the world of aircraft and atomic power.

Relating the simple facts of physical and human geography to the political fears and tensions of this chilled and nervous world, it is not surprising that political and military experts are today looking with increasing frequency and increasing disquiet at the short air routes across the new narrow seas.

The revived interest in the Arctic, however, is not exclusively the result of political and military considerations. Increasing knowledge of the North has resulted in a new appreciation of the economic possibilities of that region. And the more admirable aspect of humanity's split personality is shown in a rapidly growing recognition of the social responsibility of those who enjoy a more favourable environment for the welfare of those of our common race who have been living in half-forgotten isolation beyond the horizon of the North.

If Canadians are to understand the significance of their own northern problems it is essential that they should know more than they commonly do about their Arctic and sub-Arctic regions. With the exception of Russia, Canada has the largest holding of Arctic territory. If we are to continue to retain this vast domain of land, sea and ice, we must prove that we are conscious of our stewardship.

The first need is knowledge.

Among Canadians who have had little opportunity to visit the Arctic or to study northern conditions there are two contrasting points of view that are widely held.

Of these the first might be described as the romantic. To those whose knowledge of the North has been derived chiefly from the cinema or from the lighter forms of fiction—









The Eskimos shown in the photographs above and bottom right are at an isolated camp on an island in the Gulf of Boothia.

Left:—
Arctic Red River, an Indian summer camping area in the Mackenzie River valley.

Bottom left:
White fox pelts in the Hudson's Bay Company warehouse at Cambridge Bay





whether or not disguised as journalism—Northern Canada is usually visualized as a region in which the midnight sun is the insignia of summer, and where northern lights brighten every wintry day; where red-coated Mounted Policemen travel swiftly behind racing teams of hardy Malemutes over spotless stretches of curving snow from one encampment of jolly and hospitable Eskimos to another; where life in igloo villages is a constant round of native dances, seal hunts and feasts of fish and blubber; where Hudson's Bay factors with Indian features and Scottish names keep the Union Jack flying over trading posts meticulously spruce, and where all the resources of the family or post are made available to welcome the unexpected stranger.

Others entertain a more dismal view of the North. To these the Arctic is a land of constant struggle and unremitting hardship; where in the Biblical phrase "the waters are hidden as with a stone and the face of the deep is frozen"; where darkness persists throughout the larger part of the year and unbearable cold is its invariable companion; where starvation is the common fate and disease indigenous to all; where every human resource is required to win the primary battle of survival and life is spent amid poverty, conflict, ignorance and filth; where, to adopt the words of Thomas Hobbes, the lot of man is "solitary, poor, nasty, brutish and short".

Truth can be drawn from elements in each of these stereotypes. As a result of experience, research and invention it is now known that human life in the Arctic, while conditioned by difficulties and privations which are not commonly experienced in more settled and more temperate regions, is by no means an impossibility for men and women of normal constitution. Nor is it necessary entirely to abandon those social and intellectual activities which are the proper requirements of the educated man or woman.

What are the facts about Northern Canada ?

The Arctic and sub-Arctic regions of this country can be defined roughly as consisting of the Yukon Territory, the Northwest Territories including the Arctic Islands and their waters, the northern half of Quebec and Labrador, and that segment of the ice-capped polar sea that is caught within the Canadian sector.

In superficial area this territory includes some one and a half million square miles. It is divisible into four main sections; the Yukon Highlands, the Mackenzie Valley, the northern portions of the Canadian Shield and the Arctic Islands. Of these the most important in its potential contribution to the national economy is that great mass of ancient and weathered rock which, in the mineral zones of Ontario and Quebec, has added so immensely to Canadian wealth through its contributions of gold, silver, nickel, and other products of the mine. At Yellowknife the great Shield has already provided a basis for the largest settlement in the Canadian North. The barren and inhospitable surface of the Shield provides at once the greatest physical handicap to the development of settled communities and the greatest promise of riches upon which such communities can be established.

The climate of this area varies from the extreme winter temperatures of certain localities in the Yukon and in the northernmost islands to conditions that are quite as equable—to use a polite word—as those of such cities as Winnipeg and Ottawa.

Within this region there live today some 8,500 Eskimos and 6,000 Indians. For the most part they are to be found in nomadic or semi-nomadic groups with a cultural position that is a remarkable combination of neolithic and modern components. Here also are more than 14,000 men and women of the white race—if the ethnologists will forgive the employment of this inaccurate but useful term—most of them comparatively recent adventurers in the North.

White settlement in Canada's far northern regions has been concentrated very largely in the Mackenzie District, mostly in the vicinity of Yellowknife, at various points in the Mackenzie River valley and in the Yukon Territory. In the Eastern Arctic



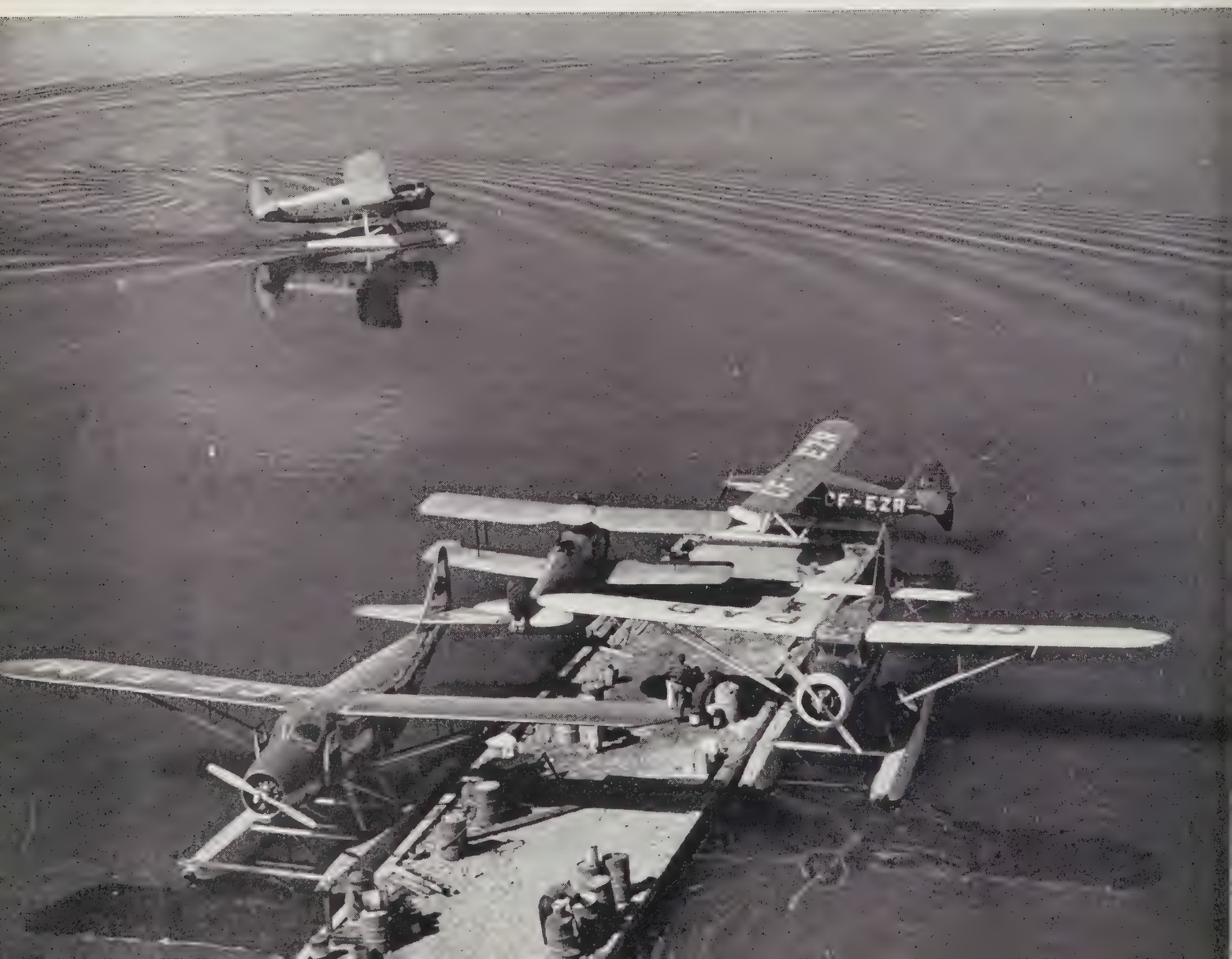
N.F.B

GREAT SLAVE LAKE

Left:—Fishermen bring their catches, which consist mainly of lake trout and whitefish, to the wharves at Gros Cap, about sixty miles south of Yellowknife.

Below: — Aircraft play an important part in the life of Yellowknife and the mines served by this northern community.

N.F.B.



white settlement is negligible. Virtually the only white persons residing in this region are the representatives of the Royal Canadian Mounted Police, missionaries, medical staff, Department of Transport personnel, traders and employees of other Federal Government services.

So much for the area, population and climate. But what are the prospects of developing resources in northern Canada adequate to sustain a considerable population—to make a significant contribution to the economic welfare of Canada ?

In a free and democratic country it is impossible to disregard the human element, in the planning of national projects, because of a desire to force the rapid development of a region that may or may not be able to provide a sound base for industry and population. In other words, Russia can employ its people as *expendable* factors in the gamble on northern development: Canada cannot. The U.S.S.R. has been able, through the use of compulsory labour, to establish a northern sea route along its Arctic shores and to build cities within the Arctic Circle. Canada will not use the same methods and it is possible that similar developments in this country will be long postponed.

This does not mean, however, that the Canadian North will forever remain a land of desolation, devoid of human activity. There is in the world today a constant and increasing demand for the kind of mineral wealth that is unquestionably to be found in the northern as well as in the southern reaches of the Precambrian Shield. It may well be that a slower development, based on a recognition of human rights and carried out with some regard to normal principles of economic practice, may in the end prove to be the most effective method of development. This is not to suggest, however, that we should not study the Russian experience or fail to learn from Russian results. But no gamble on the possibility of quick profits from the North is worth the sacrifice of the liberties of our people.

From the days of Henry Hudson to the end of World War I the economy of the North was based on fur, and the welfare of the inhabitants rose and fell with the supply and price of beaver, white fox, mink, marten and muskrat. In some areas of the North the age of fur still persists but elsewhere new foundations for the life of the region are being discovered.

Agriculture is a possibility in some parts of the Yukon and in the Mackenzie watershed, but it is likely that developments in this field will be confined to production for local use. There are few places on the continent that can produce better vegetables or berries than are to be found under the long summer sun of the Mackenzie valley or in the garden plots of Dawson and Whitehorse, but looking at the north as a whole, the percentage of arable land is not great. Grain crops can be more economically produced in the prairies to the south. The raising of cattle is likewise an expensive and doubtful project except for certain local and special needs.

In some parts of the North there are timber resources which it will one day be economic to exploit but, in general, this must wait, except for the satisfaction of local needs, on increased prices or a great reduction in the costs of transportation.

The possibility of fisheries on such a scale as to provide a new national asset is not to be disregarded. Already supplies of whitefish, lake trout and the succulent goldeye are being taken in commercial operations from the great northern lakes. Game fish also are found in numbers to satisfy the most ardent followers of Izaac Walton.

Attention should likewise be given to the possibility of further developing local handicraft industries in leather, wood, bone and other materials among the native population. The social as well as the economic values of such activities are of particular importance.

But the real development of the North will depend upon the discovery and development of mineral resources. The Yukon, having lain quiescent for nearly two generations, is experiencing a revival of mining. With cheap power in prospect and easier

N.F.B.

An aerial view of the exciting town of Yellowknife on the north shore of Great Slave Lake. The old settlement is in the background and the new section in the foreground.



Mackenzie Highway, 46 miles south of Hay River townsite on the south shore of Great Slave Lake.

means of access being developed, the Trail of '98 may again become a road to achievement. Yellowknife, the most exciting town on the continent, is only awaiting the return of a reasonable price for gold as compared with other commodities, or a reduction in the costs of transportation, to develop into a city of considerable size. On the Labrador boundary there are iron deposits of exceptional quality and of an extent that must be measured in scores of miles. $200,000,000 are to be spent on their exploitation. Base metals on the shores of Great Slave Lake, copper in many places throughout the Territories, oil in the Mackenzie valley, all give promise of permanent development. Most significant of all, are the established radium and uranium deposits at Great Bear Lake, deposits which alone would have made Canada one of the most important of countries in the new atomic age.

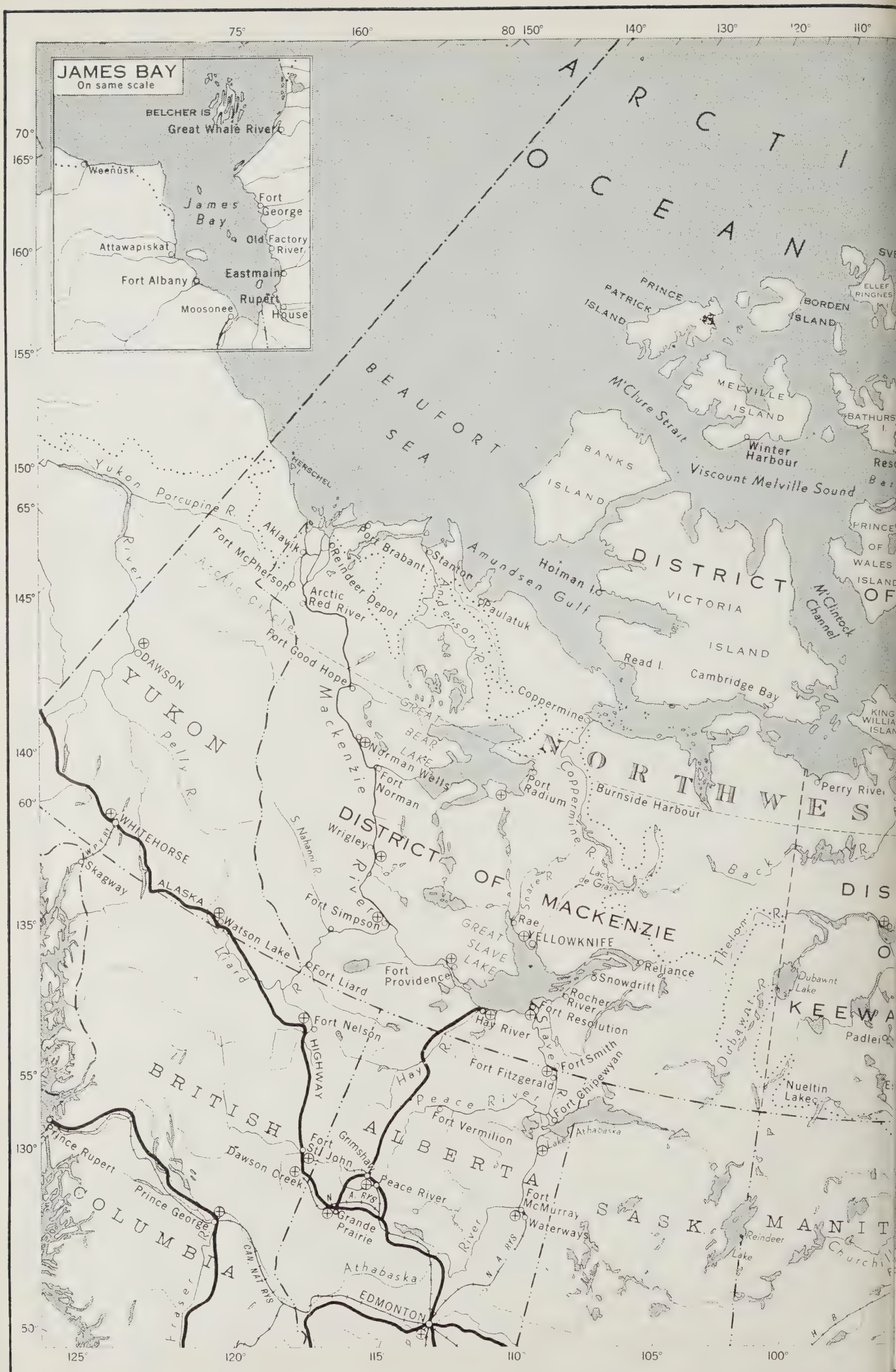
Apart from the discovery of resources, the fundamental problem of northern development is the problem of transportation. The whole history of the Canadian North can be divided into two periods—*before and after the aeroplane.* The northern mainland of Canada is a country well suited for service by air. Distances are enormous, the surface of rock, water and muskeg in summer, of snow and pressure-ridged ice in winter, makes surface travel slow and arduous. All this can be overcome by air travel. It is true that great difficulties must be overcome in establishing landing fields of a size to carry the largest commercial and military planes. But for the small plane equipped with pontoons in the summer and skis in winter, the Great Shield provides ideal conditions. There are few spots in the whole region in which it would not be possible for a plane, flying at five thousand feet, to find a safe landing—according to the season—on water or on ice. Recognizing this fact and aware of the mineral potentialities of the Shield, the early bush pilots of Canada made a fabulous record that placed this country in the forefront of commercial aviation. As a result of the work done in the northern bush and on isolated mail routes by such men as Dickins, May, Berry, Brintnell and Becker, Canada was for many years the first country in the world in the quantity of freight carried by air.

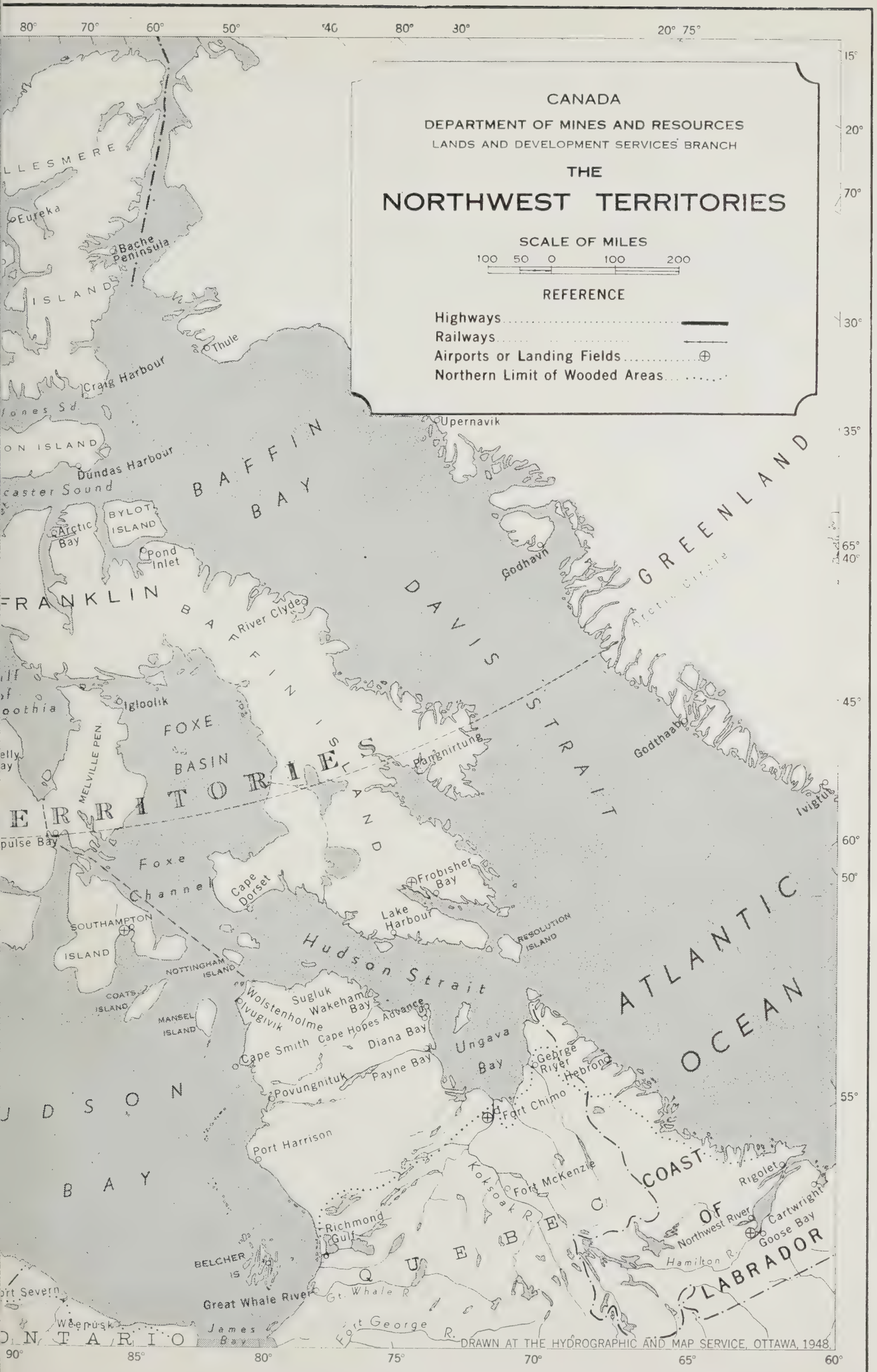
Today, scheduled airlines run from Edmonton into the Yukon and beyond, and from the same booming centre of air transport to Yellowknife and to the towns of the Mackenzie valley as far north as Aklavik. In addition, aircraft owned by individuals, corporations or the government are readily available at many posts in the Canadian North, and nowhere in that great expanse is there a spot that cannot be reached within a few hours flying. Yet it was less than a generation ago that even the simplest trip into our northern lands involved weeks of preparation and months of back-straining toil.

Other forms of arctic transport are being slowly but stubbornly developed. The Alaska Highway, constructed as a war measure, now joins together the airports of the northwest staging route and provides permanent land access to Alaska. The Atlin district, famous in the history of gold, is being linked to Whitehorse by road, and from legendary Dawson City and the Klondike another road is working south to Whitehorse, tying in on the way the mineral areas in the Mayo district. North from Alberta a highway now stretches over the tundra to Hay River, with a winter road providing ground access to Yellowknife. In addition, scientific study and experiment are pushing forward the development of more and more efficient types of snowmobiles —machines that will eventually supersede the Husky and the Samoyede as the motor car has supplanted the horse and mule.

By sea small vessels sailing out of Aklavik and Tuktoyaktuk service the weather stations and other scientific and trading posts that are spreading rapidly across the Arctic islands.

In 1950 a new vessel, constructed by the Government, will take the place of the wrecked *Nascopie* in carrying scientists, doctors, missionaries and administrators every year into the most isolated and barren areas of the eastern Arctic.


JAMES BAY
On same scale
BELCHER IS
Great Whale River
Weenusk
James Bay
Fort George
Old Factory River
Attawapiskat
Fort Albany
Eastmain
Rupert House
Moosonee
ARCTIC OCEAN
BEAUFORT SEA
PRINCE PATRICK ISLAND
BORDEN ISLAND
MELVILLE ISLAND
M'Clure Strait
Winter Harbour
Viscount Melville Sound
BANKS ISLAND
HERSCHEL
Yukon
Porcupine R.
Aklavik
Fort McPherson
Arctic Red River
Reindeer Depot
Fort Brabant
Stanton
Amundsen Gulf
Holman I.
Paulatuk
Anderson R.
DISTRICT OF MACKENZIE
VICTORIA ISLAND
Read I.
Cambridge Bay
M'Clintock Channel
PRINCE OF WALES ISLAND
Arctic Circle
Fort Good Hope
Mackenzie River
DAWSON
YUKON
Pelly R.
Coppermine
GREAT BEAR LAKE
Norman Wells
Fort Norman
Port Radium
Burnside Harbour
Perry River
WHITEHORSE
Skagway
ALASKA
S. Nahanni R.
Wrigley
Fort Simpson
Watson Lake
Liard R.
Fort Liard
Lac de Gras
Snare R.
Rae
YELLOWKNIFE
Reliance
Thelon R.
Back R.
GREAT SLAVE LAKE
Fort Providence
Snowdrift
Rocher River
Fort Resolution
Hay River
Slave R.
Fort Smith
Dubawnt Lake
Dubawnt R.
KEEWA
Padlei
Fort Nelson
HIGHWAY
Hay R.
Fort Fitzgerald
Fort Chipewyan
Peace River
Nueltin Lake
BRITISH COLUMBIA
ALBERTA
Fort Vermilion
Athabasca Lake
Prince Rupert
Fort St. John
Grimshaw
Dawson Creek
Peace River
Prince George
Grande Prairie
Fort McMurray
Waterways
SASKATCHEWAN
Reindeer Lake
Athabaska
EDMONTON
CAN. NAT. RYS.
N. A. RYS.
Fraser R.
75°
80
160°
150°
140°
130°
120°
110°
70°
165°
160°
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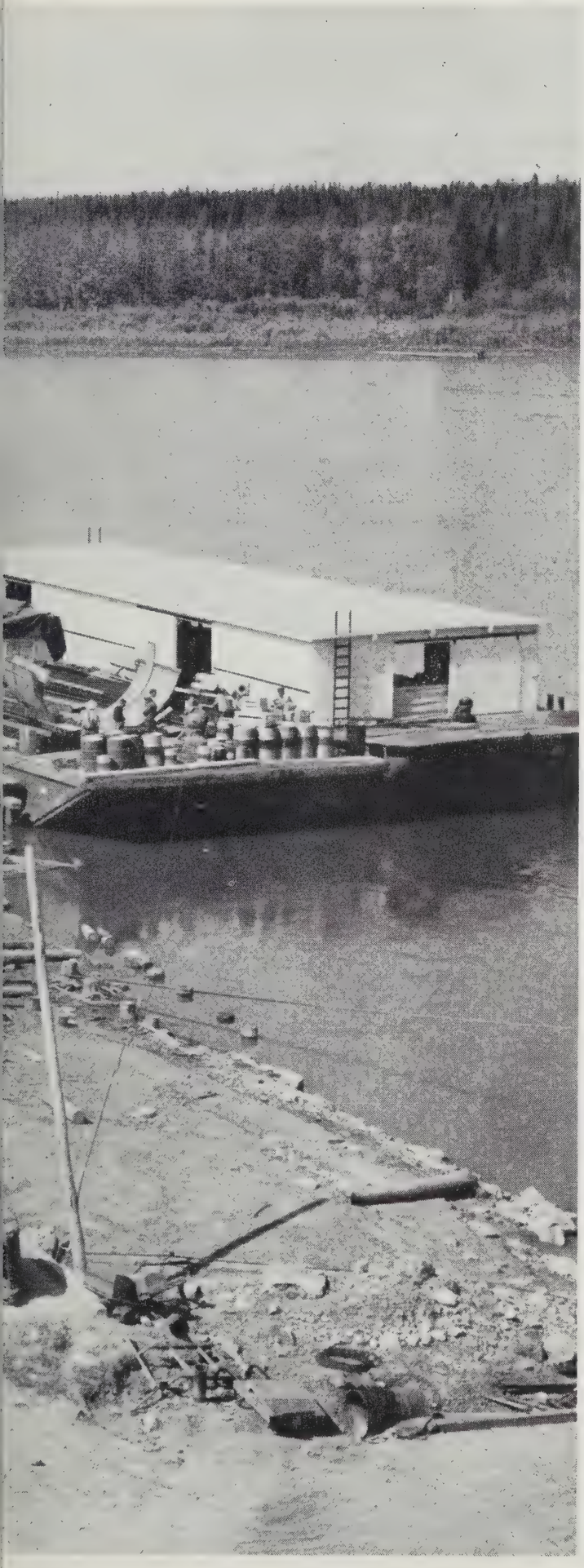


DRAWN AT THE HYDROGRAPHIC AND MAP SERVICE, OTTAWA, 1948.



N.F.B

Fort Smith, on the Slave River, near the Al
on barges at Bell Rock shipyards, eight mi
posts on the Mackenzie River.



ry. Heavy equipment is loaded
Smith, for shipment to northern

If the base metal discoveries on Great Slave Lake develop as is now expected, a railway will within a few years reach the shores of that inland sea.

But the air will always remain the chief means of transport in the Canadian North.

It is the progress made in air travel and the recognition that the shortest routes between the major modern concentrations of human activity and power pass over Arctic lands and waters that have caused most of the dramatic and headline attention that has been focussed on the North in recent years.

During the war it is known that Canada and the United States worked together in the development of northern air supply routes, both to the United Kingdom and to Siberian Russia. The northwest staging route, the development of which was started by Canada before the war and completely paid for by this country, was the line along which thousands of aircraft were sent to reinforce the Russian front. Similarly, from the central and eastern parts of the continent bombing and fighting machines were flown to embattled Britain by way of Labrador and Greenland. Today these routes are for the most part still available for commercial travel. In addition, post-war planes can fly directly and non-stop across the roof of the world from Nanking to Ottawa or from Vancouver to Moscow. In the event of another war bombers will cross the ice caps, not the open seas.

That Canada and the United States are co-operating in providing for continental defences along the northern reaches of our land is, of course, well known. The Permanent Joint Board of Defence, established by Prime Minister Mackenzie King and President Roosevelt at Ogdensburg in 1940, has since that time, both in war and in the post-war period that we cannot yet call peace, been responsible for advising the governments of these two allied nations on common problems of defence in the North as well as on their ocean frontiers.

One point in connection with this defence collaboration should be repeatedly em-



Government ionospheric station at River Clyde, eastern Baffin Island, showing laboratory, dwelling, and storehouse.

Chipewyan Indians stock up with provisions in the Hudson's Bay Company post at Churchill, Manitoba.

N.F.B.

phasized. In spite of charges made in other parts of the world and echoed in some circles in Canada, the principle of Canadian sovereignty over her own land and waters has not been placed in danger. Canada has more than paid her way in the contributions that she has made to the common problems of joint defence. Wherever military or semi-military establishments are set up on Canadian soil, they are under Canadian control. Whenever service exercises are undertaken on the lands or seas of this country, the final authority under which they are conducted is the authority of the Canadian people, expressed through our parliamentary institutions.

As international collaboration develops, it is possible that Canada may join with other nations in the relinquishment of an increasing measure of national sovereignty to some international authority. But this country has not surrendered and will not surrender the control of its territory or of its activities to any foreign state—no matter how friendly relations may be.

There has, however, been an altogether unhealthy emphasis placed on the military significance of recent developments in the Canadian North. It is undoubtedly true that Canada is doing whatever is necessary to provide for the exigencies of defence in that area, but far more significant for the long-term history of humanity on this continent is the work that is being done by the scientists, explorers, administrators, educators, missionaries, doctors and social workers who have been carrying the benefits, and occasionally and inadvertently the detriments, of our national way of life into the endless reaches of the North. These are the men and women who are working on our last frontier. It is they who will bring this harsh, stubborn and silent land into effective contact with the rest of Canada. It is through their intelligence and goodwill that the progress of our northern peoples toward integral union with other Canadians will be amicably effected. Here the old tradition that demanded extermination or forcible subjection of the native inhabitants by the conquering power is being translated into terms and practices less abhorrent to the humane and christian spirit. Amalgamation is inevitable, ruthless coercion is not.

Because little is known of the work that is being done by pioneer Canadians in Arctic regions, and because these pioneers will need others to assist and succeed them, it is worth placing briefly on record some of the important and stirring human events that are taking place along our northern horizon.

Fundamental in any record of developmental activities in the North is the work of our scientists and technicians. At the scientific research stations at Churchill and Baker Lake some of the most competent Canadian specialists are struggling with basic research problems in entomology, the mechanics of snow and ice, nutrition, archaeology, protection against cold, and many similar or related subjects. Weather stations have been established at strategic locations throughout the whole area and meteorological knowledge is rapidly expanding. Experts from the Dominion Observatory are working in the fields of geophysics and terrestrial magnetism. Geologists, topographers and geographers are exploring and recording the outer semblance and the hidden secrets of this stark and solemn land.

There is nothing exclusive about this scientific program. Indeed, nothing would give us greater satisfaction than to be able to co-ordinate our studies with those of other countries with similar problems to solve. Some progress in this direction has already been made in the exchange of knowledge and experience, particularly with the Danish administration of Greenland and with the scientists of the United States. In dealing with the North we should like in the words of the Honourable L. B. Pearson, to place the Canadian accent on "resources and research, not on strategy and politics".

In the North, as elsewhere, it is the human problem that is of the first importance. Scientific knowledge is significant only in so far as it contributes to human welfare.

It is quite clearly inevitable that the





Eskimos of the Eastern Arctic. The men (above) are on Southampton Island. The family (left) at Baker Lake are wearing their modern clothes for Sunday.

Right:—Doctor performing a spinal puncture operation on an Eskimo girl at Pangnirtung hospital, Baffin Island.

Eskimos and northern Indians will eventually be brought into the Canadian community. In spite of the fact that in some respects they are only a short distance in habit removed from the Stone Age, it would now appear that the transition will not be as difficult nor as prolonged an operation as was once expected. The Eskimos, in particular, have shown an extraordinary facility in adaptation. Not only do they readily appropriate such modern tools as the Peterhead boat and the magazine rifle but they have shown themselves to be remarkably adept in learning to handle even such complicated mechanisms as the modern aircraft engine. (It is worth noting that during the war Russian Eskimos were among the most proficient aeroplane mechanics in the hard-pressed air force of our one-time ally). Eskimos and Indians alike are adopting the clothing of civilization, although this is not invariably either an aesthetic nor a practical advantage. They are turning even too rapidly to dependence on the food and technical equipment of the white trader. Nor have the customs associated with tobacco, alcohol, games of chance and even the radio been an unmixed blessing. It has sometimes been suggested that the Eskimos were the happiest people in the world until the advance of civilization brought them white flour, liquor, measles and radio commercials.

The real problem facing the Northwest Territories and Yukon Administrations in connection with the transition of the native peoples from their nomadic, hunting and essentially neolithic existence to a modern life consonant in most of its forms with that of the more settled parts of Canada is the necessity of controlling the change in such a way that the native peoples will not lose their natural virtues in acquiring the forms and advantages of modern life. The change must be gradual and voluntary. It must be conditioned by a recognition of the values that were developed in the more primitive forms of society. Its inevitability must not be accepted as justification for compulsion or for an unnecessary fracturing of native codes, customs and ideals. The suggestion that conventional Canadian marriage forms should be demanded of all Eskimos, for example, would, if imposed at this time, simply result in antagonizing the majority of those concerned and in creating unnecessarily a whole generation of illegitimate children.

These things are recognized by those who are charged with the official responsibility for the welfare of the native populations of Northern Canada.

First among the steps that are being taken to meet the needs of our Eskimo and Indian compatriots in the Northwest Territories and the Yukon is the provision of a more adequate medical service. Conditions among the northern nomads have always been harsh; the death rate has been high, particularly at birth; and the incidence of disease has been far beyond that experienced under more normal modern conditions. To the physical and mental problems which were inherent in native life, the white man has added new perils. Diseases against which the majority of Canadians have, over generations, developed a considerable power of resistance, find the northern natives without any comparable defence. Even the common cold, of which the average Eskimo is free in ordinary circumstances, strikes down whole communities following the visits of the annual Arctic patrols. In order to meet these new and old problems the Government is establishing or subsidizing small hospitals and nursing stations at many points throughout the North. Larger hospitals with facilities for long-term treatment, particularly of tuberculosis, have been set up near the



N.F.B.



Classroom in the school at Fort Smith on the Slave River.

An Eskimo group in the store at Fort Chimo, northern Quebec, being issued with Family Allowances goods. The trader is measuring out powdered milk while his wife assists by filling out the vouchers.



northern railheads. Complete X-ray examination of the whole of the native and white population of the North is under way, and vigorous efforts are being made to isolate those who are found to be suffering from tuberculosis.

With the attempts that are being made to provide for the health of our northern compatriots goes the development of an educational system that has no counterpart in previous Canadian history. Permanent schools are being established in most of even the smaller communities, and teachers with special qualifications in the field of welfare techniques are being appointed. It is the duty of these *welfare teachers* to develop the school as the vital centre of the community as a whole. It is used for meetings, for games, for social events, for health clinics, for the organization and activities of clubs, as well as for more conventional forms of instruction. Each school is provided with moving picture and film strip projectors, with a radio receiving set and with a gramophone. School programs are broadcast regularly to the Mackenzie valley area, and efforts are being made to duplicate this service in other parts of the North. In this activity members of the Royal Canadian Corps of Signals, working voluntarily, have made a most valuable contribution. Circulating film libraries are carried on a regular schedule from school to school, and records are supplied as part of the basic equipment of each of these community centres. The teachers who undertake this work are being enlisted as regular civil servants and work throughout the year (except for the normal three weeks' leave) instead of following the customary nine and a half months schedule of the Canadian public schools. The successful welfare teacher is the symbol of the new day in the Canadian North.

In dealing with the more nomadic groups, particularly in the Eastern Arctic, still other educational techniques must be developed and many experiments are in progress or under contemplation. Travelling schools, seasonal schools, combinations of teaching and nursing centres, and other innovations are being tried in order to meet the unique conditions of this area and of these people.

Canadian social services, such as family allowances, old age pensions and special assistance to the blind and helpless, have all been carried into the Arctic Circle. As a rule it is found to be impracticable to pay such allowances in cash and in such cases the recipients are permitted to take the payment in kind. Thus on occasion the family allowances of an Eskimo group may be consolidated for the purchase of a boat, an engine or some other item of equipment which can reasonably be expected to result in additional food or clothing for the children or the handicapped. The essence of the whole

Anglican mission buildings at Aklavik, near the mouth of the Mackenzie River. Left to right: church, hospital, teacher's residence and school.





N.F.B.

Diamond drilling on a mining property near Yellowknife.

program is *flexibility*—the effort to adapt the methods to the essential purpose.

The North has been referred to as the frontier. But the frontier is more than a geographical area; it is a way of life, a habit of mind. As such, it plays a most significant role in the national life. The influence of the frontier on the intellectual, social, economic and political history of the United States has been a major theme in the historical records of that country. But the frontier in the United States disappeared about the year 1890.

This climax has not yet occurred in Canada. But whereas the frontier in American territory was a phenomenon of the West and its last stand in that country was staged in the mountain states, in Canada the frontier has persisted longest in the North. Here indeed is a true frontier and one that will never be fully conquered.

This is a matter of vital importance to the future of Canada. The virtues peculiar to frontier conditions—social and political democracy, independence and self-reliance, freedom in co-operation, hospitality and social responsibility—are virtues of particular importance in national life.

Perhaps it is here that the greatest contribution will be made by the Canadian North. Much as that area may contribute to the economic life of the country, this contribution may be of less significance than the fact that here will be a permanent source of energy from which Canada will draw strength in the never-ending fight to guard and maintain the personal and human rights of her people. As long as the frontier remains there will be Canadians who will never succumb to the dogmas of the totalitarian or the power of domestic tyranny. The frontier is a bastion of freedom, and the North is a permanent frontier.

The following publications have been prepared to provide both general and special information concerning Canada's Northland, and may be obtained without charge from the Editorial and Information Division, Department of Mines and Resources, Ottawa, Ontario.

NORTHWEST TERRITORIES

1. The Northwest Territories—Administration, Resources, Development.
2. Physical Geography of the Canadian Eastern Arctic (English and French).
3. Mineral Resources and Mining Activity in the Canadian Eastern Arctic.
4. Eskimo Population in the Canadian Eastern Arctic.
5. Economic Wildlife of Canada's Eastern Arctic—Caribou.
6. The Conquest of the Northwest Passage by the R.C.M.P. Schooner St. Roch.
7. Land Use Possibilities in Mackenzie District, N.W.T.
8. Water Transportation in the Canadian Northwest.
9. Fur Production in the Northwest Territories.
10. Weather and Climate of the Northwest Territories.
11. Exploration and Settlement of Mackenzie District, N.W.T.
12. Conserving Canada's Musk-Oxen.
13. Canada's Western Arctic.
14. Physical Geography of the Western Arctic.
15. Settlements of the Arctic (in course of preparation).

YUKON TERRITORIES

1. Yukon Territory—History, Administration, Resources and Development.
2. Agriculture and Forests of Yukon Territory.
3. Water Transportation in the Canadian Northwest (listed above).



Eskimo girls—northern Baffin Island.

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CANADA'S NORTHERN AIRFIELDS*

Introduction

Canada's northern position in the Western Hemisphere is of the greatest importance from the standpoint of air transport. The shortest airways between North America and both Europe and Asia pass over the Dominion and her co-operation is necessary for their efficient development.

When Canada went to war in 1939 immediate steps were taken to ensure the defence of her territory and, subsequently, of key points in the Western Hemisphere. Since the Ogdensburg Agreement of Aug. 17, 1940, which resulted in the creation of the Canada-United States Permanent Joint Board on Defence, these defensive measures have been co-ordinated with those undertaken by the United States and the two countries have worked out joint plans for the defence of their parts of the Western Hemisphere.

The plans for the defence of vital areas of northwestern and northeastern Canada are outstanding examples of effective co-operation between the United Kingdom, the United States and Canada. The primary purpose of these defence installations was to close the North American approaches to attack by Germany and Japan, but they have now become links in the offensive plans of the Allies. Aircraft fly across northwestern Canada to the Pacific theatre of war and across the northeast to Europe, and in post-war plans the routes hold promise of providing greater freedom for the movement of air traffic in the general scheme of international air transport.

Development of the Northwest Airways System

The Northwest Staging Route.—The northwest staging route is one of the most important in the world, being the main artery for air traffic between the United States and Alaska, and beyond Alaska to northeastern Asia.

The Route is Canadian property, owned and operated by the Canadian Government. It was initially built, developed and put into operation by Canada, and subsequently improved with the co-operation of United States army engineers and workmen. The total cost of the wartime development will be about $58,500,000 and, in final settlement, will have been borne wholly by the Government of Canada.

* This material has been revised in the Office of the Controller of Civil Aviation, Department of Transport.

The possibilities of an airway connecting with the Trans-Canada system at Edmonton to give access to all parts of northwestern Canada and Alaska had long been realized. Pioneering for such an airway was done by Canadian bush pilots who first operated in seaplanes in that part of the country in the 1920's. In 1935 a survey to determine the best route from Edmonton to Yukon and Alaska was made by the Department of Transport. Detailed engineering work was authorized in 1939 and aerodromes were planned at Grande Prairie, Fort St. John, Fort Nelson, Watson Lake and Whitehorse. Landing strips 3,000 ft. in length by 500 ft. in width with provision for future extension and radio range stations to provide a radio beam were constructed at intervals of 100 miles according to standard airway practice. Thus this initial wartime development of strategic importance—the Northwest Staging Route—was commenced.

The survey parties were still in the field at the outbreak of war, and some consideration was given to the advisability of abandoning the project in favour of more immediately pressing defence needs. It was decided, instead, to expedite completion of the route, a decision that was fully justified by subsequent events. This Canadian decision was fully supported when the Canada-United States Permanent Joint Board on Defence met in November, 1940, reviewed the defence position of the two countries and recommended to the respective Governments that the plans, then being put into effect by the Canadian Government, were satisfactory from the standpoint of both parties as regards the air route from Edmonton to Fairbanks, Alaska. Later on in the light of events, additions to the original plans were made to meet conditions that could not possibly have been foreseen. As regards costs, as explained below, the Canadian Government undertook to bear these for the whole undertaking.

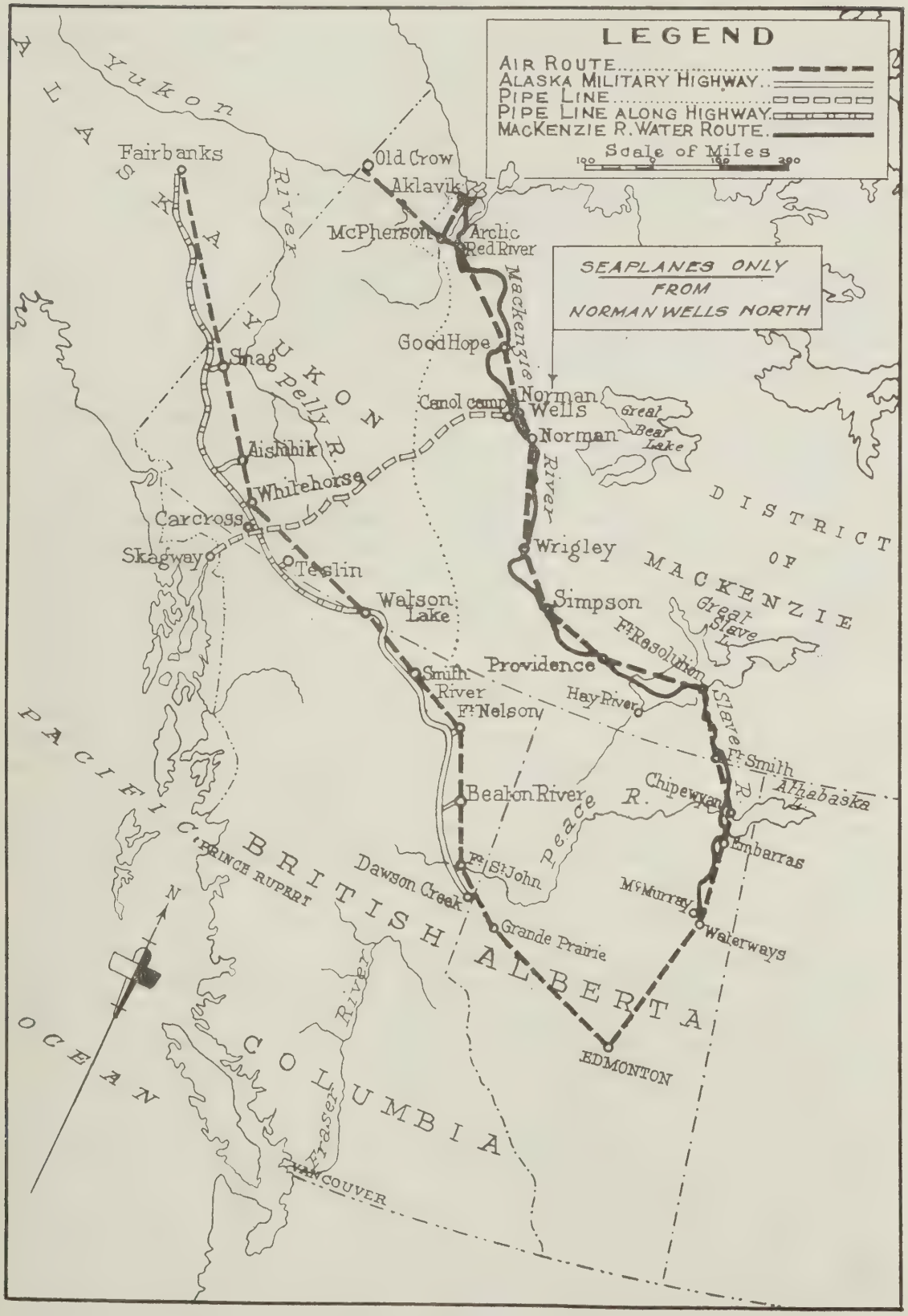
By Sept. 1, 1941, work was so far advanced that the airway from Edmonton, Alta., to Whitehorse, Yukon Territory, was usable by daylight in fine weather, and radio range stations were in operation at 200-mile intervals from Edmonton to the Alaska Boundary by the end of the year. The route thus provided an airway to Alaska which was removed from the Pacific Coast and relatively free from the danger of enemy attack and coastal weather influences. It was equipped with modern navigational aids, and connected with established air and ground communications at Edmonton and Vancouver.

By the wise decision to rush forward construction, Canada was in a position to offer to the United States, when that country entered the War in December, 1941, the free use of an airway to Alaska.

Although Canadian airway facilities were in operation at the time of the Japanese attack on Pearl Harbour on Dec. 7, 1941, it soon became apparent that war traffic would necessitate substantial additions to the original program and acceleration of the long-term peacetime plans. Military steps taken against Japan on the Pacific Coast made necessary a much more comprehensive plan than the air route. These military plans called for extensive developments involving an immense amount of construction work connected with the enlarging of airports, the improvement of facilities, the provision of living accommodation, etc.

By special arrangement with the United States Government made in the early months of 1942, Canada agreed to pay for the construction of new landing strips or other permanent works of continuing value to the Airway and the United States agreed to pay for such additional facilities over and above Canadian standards and requirements that were needed solely for United States military purposes.

THE NORTHWEST STAGING ROUTE



More recently the Canadian Government, after reviewing the probable future requirements of air transport in this area, has informed the United States Government that it will not expect payment for the construction of even those improvements carried out by the Canadian Government at the request of the United States and that Canada will also reimburse the United States Government for its own expenditures on construction of a permanent nature in connection with the Northwest Staging Route.

By February, 1942, the United States, having obtained permission of the Canadian Government, decided to build the Alaska Highway to meet the requirements of a military artery capable of handling a flow of heavy vehicular traffic. This highway followed the general route of the airway (see map on p. 3). The fact that the airway was then operating greatly facilitated the construction of this highway and, similarly, the existence of the highway has greatly aided the operation of the airway. The two projects, one carried out by Canada and the other by the United States, are complementary to each other.

By July 12, 1943, the Canadian Government, having virtually completed its own program of construction at the main fields of the Northwest Staging Route, closed out its contracts and withdrew its construction forces.

As an extension to the original highway project, flight strips were constructed by United States authorities at suitable intervals adjacent to the highway. These, however, are used only for 'contact' flying where the highway can be used as a guide by the pilot. They provide facilities for the rapid movement of construction and maintenance personnel and equipment, as well as emergency landing areas along the highway.

The Northwest Staging Route is now operated by the Royal Canadian Air Force from headquarters at Edmonton. The Department of Transport provides meteorological services, operates and maintains the radio range stations, and temporarily services communications facilities. Departmental engineers for coordinating any new work with that already done by Canada are also retained at each aerodrome along the route. Control towers are staffed by the R.C.A.F., which is responsible for maintenance and repair work at all aerodromes. The R.C.A.F. is solely responsible for security.

Expenditures on the Northwest Staging Route have amounted to $37,320,226 U.S. funds, of which $31,311,196 in U.S. funds were for permanent assets; $14,535,071 in Canadian funds were also spent by Canada up to Mar. 31, 1944. In addition Canada, during 1944, spent a further $5,161,000 at the request of the United States. Expenditures are analysed in the table at p. 8.

The Mackenzie River Route.—Canadian bush pilots have long followed the general course of the Mackenzie River northward as far as Aklavik with seaplanes and skiplanes, but once the United States Government had decided to proceed with the Canol oil project far greater payloads were available for the carriage of Canol freight to augment shipments over the Mackenzie River water route, which has very definite limitations. Twin-engined transport aircraft were decided on as the most suitable carriers, and landing facilities became necessary. These were provided by the development of landing strips at McMurray, Embarras, Fort Smith, Fort Resolution, Hay River, Fort Providence, Mills Lake, Fort Simpson, Wrigley, Norman Wells, Camp Canol, Peace River, Metis and Upper Hay River

Post. A cut-off route running between Peace River, Alta., and Mills Lake in the Northwest Territories, used mainly during the winter months, is included in the system and military transport flying is also conducted from Fort Nelson to connect with the Mackenzie System at Fort Simpson.

Service flights are now operated along the route to as far north as Norman Wells by the R.C.A.F., and civil operations extend to Aklavik. Department of Transport personnel are stationed at each location to maintain the airports, service aircraft, obtain weather reports and operate the radio ranges. Royal Canadian Corps of Signals personnel are also stationed at various points along the route to gather and transmit weather information and supplement radio communications.

Survey parties of the R.C.A.F. and the Department of Transport have conducted surveys in the field with the purpose of setting out sites against the possibility of future extension of the route to the north and northwest through Good Hope, Arctic Red River, McPherson, Bell-Porcupine and Blue Fish-Porcupine. Material and supplies are flown to these parties by float-equipped aircraft from Norman Wells.

A closely integrated network of weather observation posts and forecast stations has been established throughout the Canadian Northwest by both Canadian and United States agencies. Telephone and telegraph lines, built by the United States Government, with a capacity of 6-voice and 13 teletype communications, supplemented by several circuits added by the R.C.A.F. for Airway Traffic Control and ground line communications, are now in operation between Edmonton and Fairbanks, a total distance of 1,993 wire miles. A telephone line has been strung along the 110 miles of pipeline involved in the supplementary Canol project, and a line is being strung along the main Canol pipeline from Norman Wells to Whitehorse.

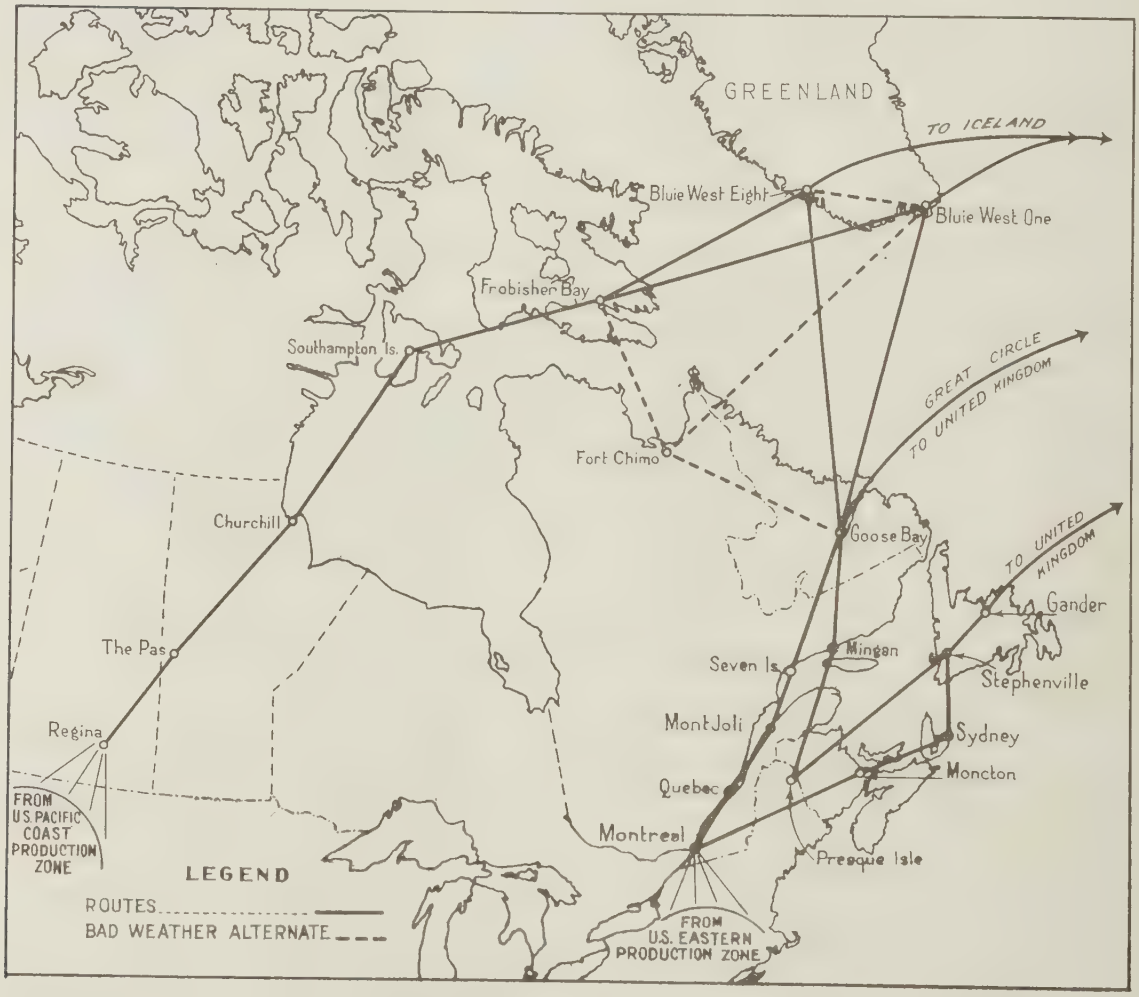
Development of the Northeast Airways

The Northeast Staging Route.—The need for a northeast staging route was originally suggested to Canada by the United Kingdom in August, 1941, with the suggestion that the matter be discussed with the United States. Long-range bombers of which the United Kingdom was greatly in need were already being ferried across the Atlantic through the Newfoundland airport at Gander, which was established to assist civil aviation by the Government of Great Britain in September, 1939. There were no facilities for ferrying short-range bombers or fighters, which were beginning to come off United States assembly lines in considerable volume, and the United States investigated the possibilities of establishing airfields in Greenland and Iceland. For many months prior to United States involvement in the War, Canadian and United States troops had been manning co-ordinated defence posts. The Armed Forces of both nations were stationed in Iceland and in April, 1941, the United States assumed responsibility for the defence of Greenland and constructed airfields which were to be available to other "American Nations", which term included Canada.

Since aeroplanes could not be transported across the Atlantic in sufficient numbers or safely through the sea lanes, it was imperative that, with the least possible delay, an air-base be opened from which aircraft arriving direct from the assembly lines of the United States and Canada could be flown across the short

North Atlantic route by way of air bases in Greenland and Iceland to the United Kingdom. In June, 1941, a site was discovered at Goose Bay, Labrador, and a preliminary survey was made. By agreement with the Government of Newfoundland, construction was begun by Canada almost immediately, and the field was in use before winter closed in. Considering the isolation of the site from the then existing communications, and the time available for planning and transporting equipment and personnel, this was an outstanding achievement.

THE MAIN CONNECTING LINKS OF THE NORTHEAST STAGING ROUTE



It was subsequently agreed by the Governments of Newfoundland and the United Kingdom that from Sept. 1, 1941, Canada should be given a 99-year lease of the Goose Bay Air Base for defence purposes; that this air base should be available to the Royal Air Force and to the United States Air Forces for the duration of the War and for such time thereafter as the parties might agree to be necessary or advisable in the interests of common defence; that the question of civil air use should remain over for settlement after the War (discussions to take place between the United Kingdom, Newfoundland and Canada within twelve months after the War) but, in any event, civil and military aircraft owned by the Government of Newfoundland should have rights to use the base on terms not less favourable than aircraft owned by the Government of Canada.

With the completion of the Goose Bay air base by Canada and the Greenland and Iceland airfields by the United States, a staging route was available for relatively short-range aircraft.

With the entry of the United States into the War on Dec. 7, 1941, the strain on the existing ferry routes became even heavier. In May, 1942, the United States Army Air Forces proposed to the Canada-United States Permanent Joint Board on Defence the establishment of air routes over northeastern Canada to ferry long-, medium- and short-range aircraft to Europe, and on June 2, 1942, the Permanent Joint Board on Defence approved and recommended immediate construction of airfields on Canadian territory either by the Canadian or by the United States Government with the approval of the Canadian Government. Facilities of the new routes were to be made available to the Royal Air Force.

From the factories of the United States Pacific Coast, aircraft would be ferried across the Canadian prairies to The Pas and Churchill, Man. From this Hudson Bay port they would fly to Southampton Island, N.W.T.; Frobisher Bay, Baffin Island; Greenland; and Iceland and from there to their destination.

This channel was to be in addition to the overland ferry route already established from eastern United States plants to the United Kingdom by way of Goose Bay, Greenland and Iceland. (See map on p. 6.)

Summary of Total War Expenditures on Canada's Northern Airfields and Policy Governing Their Apportionment

Details of the expenditures and the existence of the previously undisclosed airfields in northeastern Canada were revealed when Prime Minister King, on Aug. 1, 1944, tabled in the House of Commons an exchange of notes between Canada and the United States dated June 23 and 27, 1944.

In explanation of the Agreement by which Canada will reimburse the United States for works of a permanent nature constructed in Canada, Prime Minister King said:

> "The Government had two considerations in mind. In the first place it is believed that, as part of the Canadian contribution to the War, this country should take general responsibility for the provision of facilities in Canada and in Labrador required for the use of Canadian, United Kingdom and United States forces.
>
> "In the second place, it was thought that it was undesirable that any other country should have a financial investment in improvements of permanent value, such as civil aviation facilities, for peacetime use in this country.
>
> "I am happy to say that our views on this subject were understood by the Government of the United States, and the agreement which I have tabled is the result of this understanding."

Existing arrangements for the duration of the War for the maintenance, operation and defence of these projects are not disturbed.

The following table shows in column 2 the amounts Canada will pay to the United States for construction of airfields up to Apr. 24, 1944. Costs incurred by Canada on United States account to Mar. 31, 1944, will be found in column 3.

CANADIAN-UNITED STATES EXPENDITURES ON THE NORTHERN AIRFIELDS, DETAILED BY PROJECTS

Item	U.S. Expenditures (U.S. Dollars), Apr. 24, 1944		Canadian Expenditures (Canadian Dollars)		
	Total	Of Permanent Value	Authorized to Mar. 31, 1944	Expended to Mar. 31, 1944	Balance to Complete Construction
	$	$	$	$	$
NORTHEAST STAGING ROUTE—					
The Pas, Man.	415,000	415,000	1,253,850	921,650	332,200
Churchill, Man.	9,385,700	6,206,800	Nil	Nil	Nil
Southampton Island, N.W.T.	7,043,200	5,318,870	"	"	"
Frobisher Bay, N.W.T.	8,065,700	6,833,190	"	"	"
Fort Chimo, Que.	9,756,500	8,686,470	"	"	"
Mingan, Que.	4,285,200	3,627,980	36,160	35,000	1,160
Goose Bay, Lab.	543,000	543,000	9,950,680	6,559,756	3,390,924
Totals	**39,494,300**	**31,631,310**	**11,240,690**	**7,516,406**	**3,724,284**
NORTHWEST STAGING ROUTE—					
Aishihik, Y.T.	Nil	Nil	1,021,921	824,159	197,762
Beatton River, B.C.	"	"	941,407	418,620	522,787
Calgary, Alta.	28,517	28,517	512,178	392,448	119,730
Edmonton, Alta., air base	5,248,822	2,836,835	3,634,759[1]	3,017,350	617,409
Namoa, Alta. (Edmonton satellite field)	6,853,683	6,264,495	200,000	144,053	55,947
Fort Nelson, B.C.	6,186,892	5,477,354	1,070,822[1]	649,535	421,287
Fort St. John, B.C.	4,415,441	3,974,683	1,297,132	1,297,132	Nil
Grande Prairie, Alta.	1,968,015	1,719,956	1,255,110[1]	960,126	294,984
Kamloops, B.C.	Nil	Nil	1,037,237	769,953	267,284
Lethbridge, Alta.	"	"	142,274	41,427	100,847
Prince George, B.C.	164,732	164,732	438,761	417,903	20,858
Regina, Sask.	Nil	Nil	135,975	134,646	1,329
Smith River, B.C.	"	"	1,018,398	813,130	205,268
Snag, Y.T.	"	"	855,399	645,095	210,304
Teslin, Y.T.	"	"	862,100	784,493	77,607
Watson Lake, Y.T.	4,156,695	3,448,743	1,218,685[1]	1,035,374	183,311
Whitehorse, Y.T.	8,297,429	7,395,881	2,717,795	2,189,627	528,168
Totals	**37,320,226**	**31,311,196**	**18,359,953[1]**	**14,535,071**	**3,824,882**
FLIGHT STRIPS ALONG ALASKA HIGHWAY	3,262,687	3,262,687	Nil	Nil	Nil
MACKENZIE-ATHABASKA ROUTE	1,264,150	1,264,150	Nil	Nil	Nil
TELEPHONE LINE, EDMONTON TO ALASKA BOUNDARY	9,342,208	9,342,208	Nil	Nil	Nil
Grand Totals	**90,683,571**	**76,811,551**	**29,600,643[1]**	**22,051,477**	**7,549,166**

[1] Additional construction work undertaken by Canada in 1944 on the Northwest Staging Route at the request of the United States is estimated to cost $5,161,000 in Canadian funds as follows: Edmonton $1,250,000; Grande Prairie $1,500,000; Fort Nelson $1,803,000; Watson Lake $608,000.

YUKON TERRITORY



HISTORY, ADMINISTRATION, RESOURCES AND DEVELOPMENT



Above—***White Pass and Yukon Railway in White Pass.*** —C.P.R.

Front Cover—***Steamer "Whitehorse" in Five Finger Rapids.***

Below—***The Alaska Highway near Lake Teslin, Y.T.*** —C.P.R.



YUKON TERRITORY

A Brief Description of its History, Administration,
Resources, and Development

Issued by
NORTHERN ADMINISTRATIONS
DEPARTMENT OF RESOURCES AND DEVELOPMENT
OTTAWA, CANADA
1950



Emerald (Rainbow) Lake, Eight miles from Carcross.

YUKON TERRITORY

FOREWORD

This publication, a summary of information on Yukon Territory, has been compiled in the Development Services Branch. Acknowledgment is made of the co-operation received from those who had information of a special nature to contribute. More detailed information is contained in the various Dominion Government reports and other references listed at the end of the text.

Additional copies of this booklet may be obtained on application to the Editorial and Information Division, Department of Resources and Development, Ottawa, Canada.

R. A. GIBSON
Director
NORTHERN ADMINISTRATIONS

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YUKON TERRITORY

Location — Area — Population

YUKON TERRITORY comprises the extreme northwestern part of the mainland of Canada, and has an area of 207,076 square miles, or 5.6 per cent of the total area of the Dominion. Yukon is bounded on the north by the Arctic Ocean; on the east by Mackenzie District of the Northwest Territories; on the south by British Columbia (Latitude 60° North) and the United States Territory of Alaska; and on the west by Alaska (Longitude 141° West).

According to the decennial census of 1941, the population of the Territory was 4,914, including 3,172 whites, 1,701 Indians, and 41 others. An estimate of the population in 1948 totalled 7,512, including 5,927 whites and 1,585 Indians.

HISTORICAL SKETCH

THE early history of the area now known as Yukon Territory is largely the record of exploration carried out by resourceful and intrepid officers of the Hudson's Bay Company in extending its lucrative fur trade, and the story of adventurous miners who crossed the mountains to the watershed of the Yukon River in the age-old search for gold. Closely associated with the annals of the Yukon is the history of the adjoining United States Territory of Alaska, the development of which coincided, for a lengthy period, with that of the British territory.

The Hudson's Bay Company was incorporated in 1670 by Royal Charter granted by King Charles II, under which it received exclusive administrative and trading rights in the vast territory known as Rupert's Land. A supplementary licence conferred on the company the exclusive right to trade in the territories west of the Rocky Mountains. The North West Company of Montreal, a rival organization founded in 1784, provided keen competition, and vigorously extended its field of operations. The rival companies merged under the name of the Hudson's Bay Company in 1821, and the following year Sir George Simpson was appointed Governor and was given control of territorial affairs.

By 1838 the company had extended its trade up the Liard River to a post on Dease Lake, near the headwaters of the Stikine River. In 1840 Robert Campbell, clerk in charge of Fort Halkett on the upper Liard River, received instructions from Sir George Simpson to explore the north branch of the Liard and cross the divide in search of any river flowing westward. Campbell ascended the Liard to a lake he named Frances, continued up a tributary he called the Finlayson River, and crossed the height of land to discover the Pelly River. In 1842 Fort Frances was built, and the following year Campbell explored the Pelly River to its junction with a stream he named the Lewes River. By 1848 Campbell was in a position to extend his field of operations, and Fort Selkirk was constructed that year at the junction of the Pelly and Lewes Rivers.

In the meantime exploration of the Yukon watershed had also been instituted by the Hudson's Bay Company from the valley of the Mackenzie River. In 1842 John Bell pushed westward over the Richardson Mountains to the Bell River on which Lapierre House was established, and followed the Bell downstream to the Porcupine River. Bell explored the Porcupine in 1846 to its junction with a large river known to the Indians of the region

as the "Yukon." The name, meaning 'greatest river,' was adopted by Bell. The following year Fort Yukon was established by A. H. Murray, of the Hudson's Bay Company, on the Yukon River, three miles above its confluence with the Porcupine.

Campbell continued the exploration of the Pelly River in 1851, descending it "for hundreds of miles" to reach Fort Yukon, thus proving the Pelly and the Yukon to be the same river. (The name 'Yukon' is now applied to that part of the river below the junction of the Lewes and Pelly Rivers, although the Lewes is generally considered to be the upper Yukon). Campbell subsequently accompanied Murray up the Porcupine to Lapierre House on the Bell River and from there crossed the mountains to the Mackenzie River, establishing a new route for the transfer of supplies to, and fur from, the upper Yukon River.

Fort Selkirk was destined to have a short career. Its existence interfered with the trading activities of the Chilkat (Tlingit) Indians of the Pacific Coast, who acted as intermediaries between the Kutchin or "Stick" Indians of upper Yukon, and white traders who plied coastal waters. In 1852 the fort, which that year had been moved downstream two miles to the left bank of the Yukon, was attacked and sacked by the Chilkats in the absence of some of the personnel. Campbell sent the survivors down to Fort Yukon, and set out for Fort Simpson via the Pelly and Liard Rivers. The following spring he reached London after a remarkable trip, but was unable to obtain permission to reopen Fort Selkirk, and the Hudson's Bay Company abandoned for nearly a century its posts on the upper Yukon. (It is of interest to relate, however, that the Hudson's Bay Company reestablished a trading post at Fort Selkirk in 1938, and also one at the mouth of the Stewart River in 1939).

Exploration in Alaska

Russian exploration and exploitation of Alaska followed its discovery by Bering and Cherikoff in 1741. Fur-traders penetrated the Aleutian Islands and later extended operations to the western and southeastern coasts. In 1799 Emperor Paul granted exclusive trading rights to the Russian-American Company, which virtually ruled Alaska from that date to 1863. In 1831 Russia established a trading post on St. Michael's Island in Norton Sound, north of the mouth of the Yukon River, known there as the "Kwik-pak." The trading post of Nulato on the lower Yukon was established in 1838, and by 1846 Russians had mapped 600 miles of the river.

Russia had attempted to exclude navigators and trade from the Bering Sea and the Pacific Coast of her possessions in 1821. Protests by Great Britain and the United States led to treaties whereby the excessive demands of Russia were relinquished and boundaries established. In the Treaty of 1825 with Great Britain it was agreed that Russia would have the narrow strip of coast north of 54° 40′ and west of the summit of the mountains paralleling the coast — now known as the "panhandle" of Alaska — together with the peninsula and islands west of the 141st Meridian. In 1867 Alaska was purchased from Russia by the United States for $7,200,000, and considerable difficulty subsequently arose over demarcation of the boundary. The question was finally settled by the award of the Alaska Boundary Tribunal of 1903.

Following the sale of Alaska in 1867 the assets of the Russian-American Company were purchased by a San Francisco firm; in 1869 they were acquired by the Alaska Commercial Company. In that year the Hudson's Bay Company was forced to relinquish its trading post at Fort Yukon,

which was found by preliminary boundary survey to be in Alaska. The post was moved up the Porcupine River to Old Rampart House, but the new site was also found to be in United States territory. After being moved again upstream a few miles, the post was finally abandoned shortly after its completion. Subsequent to the retirement of the Hudson's Bay Company from the field the Alaska Commercial Company enjoyed for many years a practical monopoly of trade in the Yukon watershed, and established numerous posts within Canadian territory along the Yukon River.

Early Mining Activity

The arrival of prospectors in search of gold profoundly influenced the history of the Yukon region. Following the decline in production of the Cariboo and Omineca areas in northern British Columbia, the Cassiar field was developed about 1873. By 1875 the entire upper Liard Basin was being prospected. The next move was toward the Yukon River. A party of prospectors, including Arthur Harper, Alfred Mayo, and Leroy McQuesten, reached Fort Yukon from the Mackenzie River via the Rat, Bell, and Porcupine Rivers, in 1873. Most of this group drifted into trading, but other prospectors followed. A party of miners is reported to have crossed Chilkoot Pass in 1878, following the Lewes River to Marsh Lake. In 1880 another party following the same route reached the Teslin River. By 1885 several parties of miners had reached and commenced mining on the Stewart River. In 1886 miners were making as much as $100 per day with "rockers" at Cassiar Bar on the Lewes River and at Steamboat Bar on the Stewart River. Coarse gold was discovered in paying quantity on Fortymile River in 1886, and in 1892 the Sixtymile field was located. Trade followed the miners, and posts were established at various points, including Fort Reliance, six miles below Dawson; Ogilvie, opposite the mouth of Sixtymile River; the mouth of the Stewart River; and the mouth of Fortymile River.

The Klondike Strike

On August 17, 1896, the strike that was to make the Klondike region world-famous was made on Bonanza Creek, a tributary of the Klondike River, by George W. Carmack and two Indian companions, "Skookum" Jim and "Tagish" Charlie, on information supplied by Robert Henderson. Henderson had spent the past two years prospecting creeks in the vicinity, and in the spring of 1896 had located a fair prospect on Goldbottom Creek. On a trip down the Klondike to Ogilvie for supplies Henderson met Carmack and his companions fishing for salmon, and invited them to stake on Goldbottom. It is reported that Henderson also suggested that Carmack cross the low divide, prospect the gravels on what is now known as Bonanza Creek, and advise him if anything was found. After locating exceptionally rich placer deposits on Bonanza, Carmack and his companions proceeded to Fortymile to file their claims, but neglected to advise Henderson, who did not hear of the strike until after the entire length of the creek had been staked in the rush that followed. Henderson, however, should be regarded as the real discoverer of the Klondike.

As soon as news of the rich new strike reached the outside world a rush for the Klondike began. Pacific Coast shipping companies landed thousands at the Alaskan ports of Dyea and Skagway at the head of the Lynn Canal, from which points the fortune-seekers climbed the forbidding Chilcoot and White Passes and pressed on to Lake Lindeman, headwaters of the Lewes River. There, primitive craft were constructed for the journey of more than 500 miles down the Yukon River to the mouth of the Klon-

dike. Many others entered the country from St. Michael's, Alaska, travelling up the Yukon River to Canadian territory; along the Stikine River to Teslin Lake, moving down the Yukon; over the Dalton Trail from Chilkat Inlet; and via the Mackenzie and Porcupine Rivers. The settlement of Dawson sprang up at the confluence of the Klondike and Yukon Rivers, and in two years mushroomed from a few houses to a "city" of 25,000.

By the spring of 1899 all creeks of any importance in the Klondike had been staked, and considerable speculation in claims ensued. Newcomers staked claims on the hillsides and benches of the creeks, to the amusement of experienced miners. Many of these hill claims, however, containing what became known as the White Channel gravels, proved to be immensely rich, and made fortunes for their owners. Between 1897 and 1904, inclusive, more than $100,000,000 in gold was obtained from the placers of Klondike creeks, the greater part of it by what are now considered primitive mining methods.

The name "Klondike," according to the late William Ogilvie, is an adaptation of the Indian word "Trondiuck," meaning "Hammer-water." The stream was noted for its annual salmon run, and the natives trapped the fish by means of barriers of stakes which were driven or hammered into the gravel bed.

In the wake of the Klondike rush there followed rapid development of Yukon district. Steamer services were established on the Yukon River, both upstream and downstream, to Dawson. Construction of the White Pass and Yukon Railroad from Skagway to Whitehorse was commenced in 1898 and completed in 1900. Small towns developed at Carcross near the foot of Lake Bennett and at Whitehorse below the rapids of that name on the Lewes River. Dawson expanded rapidly, and hotels, churches, schools, and a hospital were erected. Numerous business enterprises were established, and construction of a system of roads was undertaken.

As the more easily worked placer ground in the Klondike became exhausted miners left for new fields, and the population of Dawson declined. The consolidation of mining properties under corporate bodies and the introduction of power machinery placed the industry on a more stable basis. The discovery of silver-lead deposits in the upper Stewart River country resulted in expansion of the settlements at Mayo and establishment of a new settlement at Keno. Mining enterprises established elsewhere also contributed to the economy of the Territory.

Recent Developments

The inauguration of joint defence projects in northwestern Canada in 1942 brought renewed activity to Yukon Territory. Construction of the Alaska Highway from Dawson Creek, British Columbia, to Fairbanks, Alaska, through southern Yukon, resulted in a temporary influx of population that rivalled that of the Klondike rush. The Canol Project, involving construction of a pipeline for the transportation of crude oil from Norman Wells, Northwest Territories, to Whitehorse, Yukon, and construction of an oil refinery at Whitehorse, also contributed to a large transient population. Development of the Northwest Staging Route in 1941 had resulted in the construction of a chain of modern landing fields for aircraft along the route followed by the Alaska Highway. On the termination of the Canol Project in 1945 the operation of the refinery and pipeline was suspended. The Alaska Highway and adjacent air bases, however, provide a dependable route for motor and air transportation to Yukon Territory from the prov-

inces and from Alaska, and should be important factors in the further development of the Territory.

In 1947 the Department of Mines and Resources commenced reconstruction of the old Whitehorse-Mayo-Dawson road into an all-weather road. A start was made on the Mayo-Minto section of this road in 1948, and work is being continued in order to make the Tantalus Butte coal mines at Carmacks accessible by road to Mayo and Keno. Work has also been started on the Atlin road, which will eventually give Atlin access to the Alaska Highway by an all-weather road.

Scientific Exploration

Early scientific exploration of what is now Yukon Territory included the travels of Robert Kennicott, United States naturalist, on the Porcupine River in 1861, and investigations undertaken by Dr. A. Krause, of the Bremen Geological Society, in the vicinity of Chilkoot and Chilkat Passes in 1882. In 1883 Lieutenant Frederick Schwatka, of the United States Army, undertook a survey of physical features and native population along the Yukon River. Schwatka's party crossed Chilcoot Pass, built a raft on Lake Lindeman, and successfully navigated the Lewes and Yukon Rivers to the mouth of the latter. Many place names in Yukon owe their origin to Schwatka.

In 1887 Dr. George M. Dawson, of the Geological Survey of Canada, led a Dominion Government expedition to explore that portion of the Northwest Territories drained by the Yukon River. Dawson entered the interior by way of the Stikine River and Dease Lake, and followed Campbell's route of 1840 via Frances Lake to the site of Fort Selkirk at the junction of the Lewes and Pelly Rivers. From Fort Selkirk Dawson ascended the Lewes, crossed Chilcoot Pass, and reached the Pacific Coast at the head of the Lynn Canal.

Other members of the expedition included William Ogilvie, D.L.S., of the Department of the Interior, and R. G. McConnell, of the Geological Survey of Canada. Ogilvie descended the Lewes and Yukon Rivers, conducting an instrument survey in connection with the determination of the 141st Meridian. The following year Ogilvie explored the Porcupine River basin. Later he served as the first Commissioner of Yukon Territory. McConnell accompanied Dawson to Dease Lake in 1887, later descending the Liard and Mackenzie Rivers. In 1888 McConnell crossed the height of land from the Mackenzie River to Fort Yukon via the Bell and Porcupine Rivers, and ascended the Yukon and Lewes Rivers to reach the Lynn Canal. Reports of these explorations included excellent descriptions of the physical, geological, and general features of the districts traversed. They contributed greatly to the general knowledge of the Territory.

Further exploration and numerous surveys have since been undertaken in Yukon Territory, including the investigations of G. M. Dawson, R. G. McConnell, Joseph Keele, Charles Camsell, W. E. Cockfield, D. D. Cairnes, and H. S. Bostock, of the Geological Survey. Their reports contain valuable information concerning the physical characteristics and natural resources of the region. More recent studies have included geological, topographical, geodetic, agricultural, and archæological surveys along the Alaska Highway and access roads, as well as highway, airport, fisheries, and other surveys elsewhere. Considerable detailed geological and topographical mapping has been completed with the aid of aerial photographs, and an expanded program to complete the mapping of the territory is now under way.

GOVERNMENT AND ADMINISTRATION

PRIOR to 1895 the area now contained in Yukon Territory formed part of the unorganized Northwest Territories and, although administered by the Dominion Government, was virtually occupied and controlled commercially by foreign traders. In 1895 Yukon was created a district of the Northwest Territories, and a detachment of Royal Northwest Mounted Police under Inspector C. Constantine was sent to Fort Cudahy (Fortymile) on the Yukon River to represent the various Dominion Government departments. By 1896 the mining industry had grown to such proportions that the Inspector was no longer able to handle the necessary transactions and a Collector of Customs was appointed. In 1897 an officer was appointed from Ottawa to represent the Department of the Interior as Gold Commissioner, surveyor, and land agent, and the recording office was transferred from Fortymile upstream to the present site of Dawson.

In 1898 Yukon was created a separate territory by Act of Parliament (the Yukon Act) and provision was made for a local government composed of a chief executive styled Commissioner, and a Legislative Council of six members appointed by the Governor in Council. In response to a demand for responsible government the Yukon Act was amended in 1899 to provide for the election of two additional members to the Council, with the same powers and duties as the six appointed members. The Act was amended in 1902 to provide for a council of eleven members, five to be elected. In 1908, by further amendment, provision was made for a wholly elective council of ten members to be elected for a term of three years. This form of local government continued until 1919, when the council was reduced to three members.

Present Government

The Territorial Government is now composed of the Commissioner of Yukon Territory, and an elective Legislative Council of three members having a three-year term of office. The Yukon Territorial Council, with the Commissioner, operates in a manner somewhat similar to a provincial government. The Council sits separate from the Commissioner and presents ordinances passed by it to the Commissioner for his assent. The seat of local government is at Dawson.

The Yukon Act provides that the Commissioner shall administer the government of the Territory under instructions given him from time to time by the Governor in Council or the Minister of Resources and Development at Ottawa.

The Commissioner in Council has the power to make ordinances dealing with the imposition of local taxes, sale of liquor, preservation of game, establishment of territorial offices, maintenance of prisons and municipal institutions, issuing of licences, incorporation of companies, solemnization of marriage, property and civil rights, administration of justice, and generally all matters of local nature in the Territory.

Members of Council

The Territory is divided into three electoral districts, namely Dawson, Mayo, and Whitehorse. The Territorial Council elected in 1949 for a three-year term follows:

Dawson District.....CHARLES JOSEPH LELIEVRE, Dawson
Mayo District.....ERNEST J. CORP, Keno Hill
Whitehorse District....R. GORDON LEE, Whitehorse

Federal Representation

In 1902 the Territory was granted the right to elect a member to the House of Commons, and J. H. Ross, who resigned the office of Commissioner to contest the new constituency, was elected the first Member of Parliament. In 1947, the electoral district of YUKON was enlarged by the addition of that part of the District of Mackenzie, Northwest Territories, lying west of the 109th meridian of west longitude. The new electoral district is known as YUKON — MACKENZIE RIVER. The present member is J. Aubrey Simmons, M.P.

General Administration

The Lands and Development Services Branch of the Department of Mines and Resources is responsible for business arising from the general administration of the Territory under the Yukon Act and Ordinances passed by the Territorial Council; for the disposal of lands and timber under regulations authorized by the Dominion Lands Act; for the administration of the Yukon Placer and Quartz Mining Acts; and for the collection of revenue therefrom. In addition to the Department of Resources and Development, other federal departments function in Yukon Territory. These include the Departments of Transport, National Defence, Public Works, National Revenue, Post Office, Justice, Fisheries, and Agriculture.

The Commissioner of Yukon Territory is stationed at Dawson and represents the Department of Resources and Development and some other Dominion Government departments having interests in the Territory. In addition to being head of the territorial administration, he is ex-officio Mayor of Dawson, and Registrar of Land Titles for Yukon Territory.

The Yukon Act also provides for the appointment of a Public Administrator, whose principal function is the administration of estates, including those of insane persons.

There are three mining districts in the Territory—Dawson, Mayo, and Whitehorse — with Mining Recorders in each. The Mining Recorders also serve as Dominion Lands and Crown Timber Agents. The Territorial Government maintains an Assay Office at Keno in the Mayo District.

The Superior Court of Record is the Territorial Court, over which a stipendiary magistrate presides. The Court has both civil and criminal jurisdiction, and the Court of Appeal for the Province of British Columbia is the Court of Appeal for Yukon Territory.

The enforcement of law and order in Yukon Territory is the responsibility of the Royal Canadian Mounted Police. A sub-division has been established at Whitehorse, and detachments are also stationed at Dawson, Mayo, Old Crow, Fort Selkirk, Haines Junction, Teslin, and Watson Lake.

SOCIAL SERVICES

Medical and Hospital Services

RESIDENT doctors in Yukon Territory are located at Dawson, Whitehorse, and Mayo, and function as medical health officers under the Territorial Health Ordinance. Resident dentists also practise at Dawson and at Whitehorse. Medical and dental officers attached to the Canadian Armed Forces in the Territory are registered under the Ordinance and may furnish medical and dental services to civilians and to natives in outlying parts of the Territory where such officers may be stationed from time to time.

Yukon Territory is served by three hospitals. St. Mary's Hospital, at Dawson, owned and operated by the Sisters of St. Ann, has a capacity of one hundred beds. This institution has special accommodation for indigent patients, consisting almost entirely of aged and infirm dependants without relatives to take care of them.

Whitehorse General Hospital is owned and operated by the Territorial Government, assisted by a locally-constituted hospital board. A doctor resident in Whitehorse serves as the medical superintendent. This institution has a capacity of sixty beds.

Mayo General Hospital is also owned by the Territorial Government and is operated under the supervision of a local hospital board. It has a capacity of seventeen beds.

All hospitals are staffed with graduate nurses, and possess modern facilities such as well-equipped operating rooms, up-to-date X-ray equipment, facilities for therapeutic treatment, electrically operated sterilizers, adequate refrigeration, and special rooms for observation of isolation cases and mentally-deranged patients.

The Yukon Territorial Council votes substantial sums of money annually toward the cost of maintaining these hospitals and also toward construction costs. The cost of caring for indigent patients is covered by an annual grant. Old Age Pensions and Pensions for the Blind have now been extended to the Yukon Territory.

Education

Schools for the education of white and half-breed children in Yukon Territory are maintained by the Territorial Government. Public schools are operated at Dawson, Mayo, Whitehorse, Carcross, Teslin, Brook's Brook, Swift River, and Destruction Bay. The three last-named schools are one-room buildings, situated on the Alaska Highway, and are operated for the benefit of children of Alaska Highway maintenance personnel. In addition to the above institutions, St. Mary's Separate School, in Dawson, operates as a day school, and the Convent of Christ the King, at Whitehorse, as a residential school. The latter is also open to day pupils.

The public schools at Dawson and Whitehorse have high school departments providing education leading to university entrance. University entrance (junior matriculation) examinations are held in June at Whitehorse and at Dawson by authority of the British Columbia Department of Education. The papers are forwarded from Victoria, and returned there to be graded. In outlying districts use may be made of correspondence courses provided at nominal cost by the British Columbia Department of Education.

The British Columbia curriculum is followed in Yukon schools. Whenever possible, teachers holding British Columbia certificates are employed, although in recent years some teachers with Alberta certificates have been engaged. Educational matters in the Territory are in charge of a Superintendent of Schools, resident at Dawson, who is responsible to the Commissioner. Annual inspections of all schools are made by the Superintendent.

The education of native children is carried on in two types of schools. The day schools are operated by the Indian Affairs Branch and the residential schools by religious denominations. The residential schools are given a per capita grant for each Indian child registered therein.

TOWNS AND SETTLEMENTS

DAWSON, the capital, with a population of about 800, and Whitehorse, population approximately 3,845, are the largest settlements in Yukon Territory. Other centres of population include small settlements adjacent to mining properties, trading posts situated along the main rivers, Indian villages, and groups of buildings connected with airports and other facilities for transportation. Following will be found brief descriptions of the more important places in the Territory.

Aishihik, an intermediate aerodrome, is situated in southwestern Yukon at the northwest end of Aishihik Lake. It is equipped with a radio range and meteorological station, and is accessible by road from the Alaska Highway.

Burwash is situated near the north end of Kluane Lake, about 186 miles west of Whitehorse. It is served by the Alaska Highway and is also on the route of air lines operating from Whitehorse to Fairbanks. The settlement contains a trading post, hotel, and an emergency landing field, and is an outfitting centre for big game hunting parties. Kluane Lake, situated in southwestern Yukon, is one of the largest and most beautiful bodies of water in the Territory. The lake lies northeast of the St. Elias Mountains, whose snowy summits and glistening glaciers may be seen from points along the Alaska Highway. Discoveries of gold on a number of streams entering the lake caused a small gold rush in 1903-4.

Carcross, at the northern end of Lake Bennett, is the first town reached on entering Yukon Territory by the White Pass and Yukon Railway. It has a landing field, suitable water area for a seaplane base, Church of England and Roman Catholic churches, a post office, a day school, and an Indian residential school. Connection may be made at Carcross during the summer months with a steamer that operates on Tagish Lake and Taku Arm. "Carcross" is a contraction of the name "Caribou Crossing," so called on account of the great number of caribou that once crossed the narrows between Lakes Bennett and Nares. Carcross is connected with Whitehorse and the Alaska Highway by motor road. Lake Bennett lies astride the British Columbia-Yukon boundary and also is one of the beautiful lakes in the Territory. The eastern shore is skirted by the White Pass and Yukon Railway line, from which may be observed the remarkable colouring of the mountains which, capped with snow, rise along each side. Lake Bennett and its companion body of water to the south, Lake Lindeman, were points of embarkation for thousands of gold-seekers who crossed the Chilcoot Pass and launched rough boats for their perilous voyage down the Lewes and Yukon Rivers to the goldfields in 1897-98.

Carmacks, on the west bank of the Lewes River about 110 miles north of Whitehorse, is an Indian settlement containing a post office, and a trading post. It is also the first junction of the water and overland routes north from Whitehorse. In the vicinity are large deposits of coal. A few miles downstream on the Lewes River are the famous Five Finger Rapids, which provide a thrilling experience for river steamer passengers.

Champagne, situated about 56 miles west of Whitehorse on the Alaska Highway, is an Indian village and contains a trading post. About 42 miles west is the junction of the road from Haines, Alaska.

Dawson, administrative centre of Yukon Territory, is situated on the east bank of the Yukon River, north of its confluence with the Klondike

River. It is named after Dr. G. M. Dawson, a geologist who explored the region in 1887. Dawson is a base of supply and distributing point for the Klondike goldfields, and has a population of about 800. In addition to the Dominion Government administrative buildings, Dawson contains a Royal Canadian Mounted Police detachment, two banks, a telegraph office, a Government radio station (Department of National Defence); a weather station; a post office; high, public, and separate schools; a public library; a hospital; Church of England and Roman Catholic churches; a motion picture theatre; stores, hotels, and substantial private residences. The town has electric light, telephone, and water services. A system of roads radiates from Dawson to the placer mining areas of the Klondike district where large gold dredges operating in the creeks and valleys are of great interest to tourists. A ferry provides a means of crossing the Yukon River to West Dawson, and a truck road extends westward to the Alaskan boundary and beyond to placer camps situated on upper Forty-mile River in Alaska. A landing field for aircraft is located in Klondike River Valley, 12 miles from Dawson.

Fort Selkirk, an Indian village and trading centre, is situated near the confluence of the Pelly and Yukon Rivers about 178 miles from Dawson. It has a post office, an emergency aeroplane landing field, Church of England and Roman Catholic churches, and a detachment of Royal Canadian Mounted Police. Fort Selkirk is the site of a Hudson's Bay Company fort constructed in 1848 and destroyed by Indians in 1852. Traces of the fort still remain. The Hudson's Bay Company re-established a trading post at Fort Selkirk in 1938. Fort Selkirk is the commercial centre for the fur trade of the Pelly River district, and a starting point for big game hunting parties.

Frances Lake is a trading post situated on the eastern shore of Frances Lake in southeastern Yukon. It has a private commercial radio station.

Fortymile is a small placer mining settlement situated on the west bank of the Yukon River, about 47 miles below Dawson at the mouth of Fortymile River. It has a post office.

Keno is situated in the Mayo mining district and is served by a good road from Mayo, about 35 miles distant. The settlement has a post office and a Territorial assay office.

Mayo, situated on the north bank of Stewart River about 180 miles from Yukon River, is the commercial headquarters of the Mayo mining district. It has a mining recorder's office, a detachment of Royal Canadian Mounted Police, a public school, Church of England and Roman Catholic churches, a post office, a Government radio station (Department of National Defence), a weather station, hospital, and several stores. A landing field is located near the town. Roads extend from Mayo to the silver mines on Galena and Keno Hills, and to placer gold mines on Highet, Haggart, and Dublin Creeks. Mayo has a population of nearly 300.

Old Crow is a fur-trading centre and Indian village on the north bank of Porcupine River at its junction with Old Crow River. It has a Royal Canadian Mounted Police detachment, a trading post, and a Church of England mission, and has two-way radio communication.

Ross River is an Indian village with a trading post, situated at the confluence of the Ross and Pelly Rivers about 200 miles upstream from the confluence of the Pelly and Yukon Rivers.

Snag is a trading post and intermediate aerodrome in western Yukon. The aerodrome is equipped with a radio range and meteorological station and is accessible from the Alaska Highway. The record low temperature for Yukon Territory (–81°F.) was recorded at Snag in February, 1947.

Stewart River, a trading centre and post office, is situated on the Yukon River at the mouth of the Stewart River. Connection is made here with steamers operating on the Stewart River and serving points in the Mayo mining district.

Teslin, with a fur-trading post, hotel, and a post office is located on the east side of Teslin Lake, about 114 miles southeast of Whitehorse on the Alaska Highway. It contains a Royal Canadian Mounted Police detachment, and Church of England and Roman Catholic churches. An intermediate aerodrome equipped with a weather station is situated near the settlement. There is an Indian village nearby.

Watson Lake, situated in the southeastern part of Yukon Territory, possesses a post office, a good airport, and a weather station, and is served by Canadian Pacific Air Lines Limited. It is also accessible by a spur road from the Alaska Highway. There is a Roman Catholic church near the airport. A Royal Canadian Mounted Police detachment is stationed in the settlement.

Whitehorse, situated on the Alaska Highway about 42 miles north of Carcross, is the terminus of the White Pass and Yukon Railway and the head of navigation on the Yukon River. It has a first class airport, equipped with radio range and meteorological stations, served by air lines from Seattle, Vancouver, Edmonton, and Fairbanks, as well as hotels, bank, hospital, stores, weekly newspaper, Church of England and Roman Catholic churches, and public and high schools. The headquarters of the Royal Canadian Mounted Police for the Yukon and the office of the Mining Recorder for the Whitehorse district are also located in the town. Whitehorse is an important outfitting centre for big game hunting parties. From Whitehorse a motor road provides access to the famous Whitehorse Rapids and Miles Canyon on the Lewes River, which were navigated by many of the gold-seekers in the rush of 1897-98. A foot-bridge across the canyon is a fine vantage point from which to view the rushing waters.

COMMUNICATION

COMMUNICATION with Yukon Territory from outside points is maintained by telegraph, telephone, radio, and mail services, details of which will be found in the following paragraphs.

Telegraph

The Dominion Government telegraph system connects Tagish, Whitehorse, and Dawson with points in British Columbia. This service was inaugurated in 1899, when the system was extended from Ashcroft, via

Hazelton, Telegraph Creek, and Atlin, British Columbia, to the places mentioned. This line provides connection with commercial telegraph services in other parts in Canada. A telegraph line which was constructed along the route on the Alaska Highway provides communication between Edmonton, Alberta, and Fairbanks, Alaska, and also serves intermediate points in Yukon Territory.

Radio

The Yukon and Northwest Territories radio system, operated by the Royal Canadian Corps of Signals, Department of National Defence, provides communication between Whitehorse, Mayo, Dawson, and Edmonton. The system also ties in with stations located at principal settlements in Mackenzie District of the Northwest Territories, and those in northern Alberta. Radio stations operated by the Department of Transport in connection with airports and landing fields along the Northwest Staging Route include those at Watson Lake, Teslin, Whitehorse, Aishihik, and Snag. Private commercial radio stations are operated by private enterprise at Carcross, Carmacks, Clear Creek, Frances Lake, Sixtymile River, Teslin, and Windy Arm, and by the Royal Canadian Mounted Police at Old Crow.

Telephone

A telephone system operated by the Yukon Telephone Syndicate in Dawson also serves various mining centres in the outlying districts. Mayo Utilities Company operates a telephone service in Mayo, and also from Mayo to Keno, Elsa, and intermediate points. An automatic telephone service is operated in Whitehorse. It serves the various departments of Government service, the airport, transportation services, and business and residential sections of the town.

A telephone line paralleling the route of the Alaska Highway and providing long distance telephone service connects Edmonton and Fairbanks and serves intermediate points. The line is operated by the Canadian National Telegraphs, under the administration of the Department of Transport. Another line, built from Skagway to Whitehorse, is operated by the White Pass and Yukon Railway.

Mail Services

Mail Services by Air.—

Whitehorse — Daily except Sunday from Edmonton and Vancouver.
Daily except Friday from Fairbanks.
Daily except Monday and Friday from Seattle.

Dawson and Mayo — Twice weekly from Whitehorse.

Watson Lake — Tri-weekly from Edmonton, Vancouver, and Whitehorse.

Carmacks, Minto, and Fort Selkirk — Weekly in winter from Whitehorse.

Stewart River — Semi-monthly in winter from Dawson.

Ordinary Mail Services.—Ordinary mails are conveyed from Vancouver by Pacific Coast steamship service to Skagway, and from Skagway by railway to Whitehorse for dispatch to destination. Mail service is maintained twice a week in summer between Whitehorse and Dawson by steamer, via Carmacks, Fort Selkirk, and the Stewart River, and weekly mail service is provided from the Stewart River to Mayo. Carcross is served by the White Pass and Yukon Railway according to frequency of service between

Skagway and Whitehorse. Other points in Yukon, including Champagne, Readford, Granville, and Glacier Creek, have regular mail service in summer and winter. Keno is served weekly in summer and twice a month in winter from Mayo. Teslin receives mail from Whitehorse twice a month the year round. Mail service from Dawson to Fortymile and to Eagle, Alaska, is provided monthly.

During the autumn, winter, and spring seasons, when steamer service between Vancouver and Skagway operates on a reduced frequency, a supplementary land service operates over the Alaska Highway between Dawson Creek, B.C., and Whitehorse, Y. T. It alternates with the steamer service, approximately 25 trips being made during the period.

There is also in operation over the Alaska Highway a second service, between Dawson Creek, B.C., and the Alaska-Yukon boundary, which serves all post offices on the Highway, except Whitehorse, as well as all settlements without post office facilities. The stage drivers provide the settlements with a type of post office service. This service operates all year with approximately 92 trips scheduled per annum.

TRANSPORTATION

YUKON TERRITORY is served by water, railway, air, and highway transportation.

During the winter season parcel post services to and from post offices in Yukon are restricted to the following: Carcross, Whitehorse, and Champagne — rates and services same as during summer; Watson Lake, Carmacks, Fort Selkirk, Mayo, Stewart River, and Dawson — by air stage service at the rate of 30 cents for the first pound and 25 cents for each additional pound; Lower Post and Teslin — by motor vehicle service at the rate of 25 cents per pound.

Steamship Service

The Canadian Pacific Railway Company operates a steamship service the year round from Vancouver to Skagway, calling at intermediate points in British Columbia and the Alaska "panhandle." During the summer tourist season six trips are made each month. Additional information concerning sailings and rates may be obtained from any passenger agent of the Canadian Pacific Railway Company in Canada and the United States.

The Canadian National Railways operates a year-round steamship service from Vancouver to Ketchikan, Alaska, and summer service from Vancouver to Skagway.

Railway Service

The White Pass and Yukon Railway connects the port of Skagway with Whitehorse, 110 miles distant, the head of navigation on the Yukon River system. During the summer season, a normal service is provided daily except Sunday, and twice a week during the remainder of the year. Railway Express Agency maintains offices at Skagway, Carcross, Whitehorse, Mayo, and Dawson.

River Steamer Service

During the season of navigation, which extends approximately from May 15 to October 15, the British Yukon Navigation Company (White Pass and Yukon Route) operates passenger steamboats on the Yukon River between Whitehorse and Dawson. The schedule provides for regular trips approximately 10 days apart, providing connection, in co-operation with the White Pass and Yukon Railway, with Canadian Pacific steamships at Skagway. The trips downstream from Whitehorse to Dawson usually take about two days, and those upstream four days.

In addition the British Yukon Navigation Company provides limited unscheduled services downstream from Dawson to Eagle and the mining districts of Coal Creek and Woodchopper Creek, Alaska, for the transportation of freight. Supplies for the settlement of Old Crow on the Porcupine River are transferred to launches at Coal Creek Landing.

River steamer passenger services are not available at present between Dawson, Yukon Territory, and Circle, Alaska, but occasional sailings of boats with river freight may be undertaken if warranted.

Unscheduled steamer services are operated on the Stewart River to serve Mayo and the Mayo mining district. Frequency of service will be determined by the volume of freight to be carried. These services connect with the main Yukon River route at the Stewart River settlement, situated at the confluence of the Stewart and Yukon Rivers.

A tourist excursion on Tagish Lake is operated during the summer tourist season by the British Yukon Navigation Company. Connection with the steamer *Tutshi* is made at Carcross, from which point trips are made to the resort "Ben My Chree" at the southern end of West Taku Arm, an extension of Tagish Lake. Schedules are arranged to permit passengers on Canadian Pacific steamships to make the trip during the period of two days in which ships lay over at Skagway. Additional information concerning steamer services in Yukon may be obtained from offices of the White Pass and Yukon Route at Seattle, Washington; Vancouver, British Columbia; Skagway, Alaska; and Whitehorse, Yukon Territory.

Air Services

Extension and improvement of commercial air services have brought Yukon Territory within a few hours' flying time of populated centres in Western Canada and northwestern United States. Passenger services are maintained daily, except Sunday, by Canadian Pacific Air Lines from Vancouver to Whitehorse, and from Edmonton to Whitehorse, via Fort St. John, British Columbia. These services, which extend to Fairbanks, connect with those of Trans-Canada Air Lines and other companies at Edmonton and Vancouver. A service is maintained twice a week from Whitehorse to Dawson, via Mayo, by Canadian Pacific Air Lines.

Whitehorse also is a regular stop for Pan American Airways aircraft which operate on regular schedules between Seattle and Fairbanks.

A well-equipped licensed airport is operated at Whitehorse, which is one of the principal aviation centres along the Northwest Staging Route. Intermediate aerodromes, equipped with meteorological and radio range stations, are located at Watson Lake, Teslin, Aishihik Lake, and Snag in Yukon Territory. Unlicensed airports and auxiliary or emergency landing fields are also situated at Braeburn, Burwash Landing, Carcross, Clear Creek, Dawson, Fort Selkirk, Mayo, McQuesten, Minto, and Yukon Crossing. Flight strips, constructed to aid contact flying, are also available along the route of the Alaska Highway.

The Alaska Highway

The highway system in the Territory includes that part of the Alaska Highway which traverses southern Yukon; access roads to airports along the Northwest Staging Route; all-weather roads which radiate from Whitehorse, Dawson, and Mayo to the adjacent mining districts; and a road connecting Whitehorse with Carcross. An-all weather road to connect Whitehorse with Mayo and Dawson is now under construction.

The Alaska Highway provides direct connection with Yukon Territory from both Edmonton and Fairbanks. The highway also links the town of Whitehorse with the settlements of Watson Lake, Teslin, Champagne, and Burwash. The port of Haines, Alaska, southwest of Skagway, is connected with the Alaska Highway by the Haines Cut-off road. A brief description of the highway will be found in the following paragraphs.

The Alaska Highway (Canadian section) commences at Dawson Creek, British Columbia, (Mile 0·0) and enters Alaska at Mile 1221·4. Dawson Creek is the western terminus of a branch of the Northern Alberta Railways, and is also served by the provincial highway systems of Alberta and British Columbia. It is approximately 495 miles by railway, and 475 miles by highway (shortest route) from Edmonton. Approximate mileages from ports of entry into Canada to Dawson Creek are as follows: Kingsgate to Dawson Creek, B.C. (via Cranbrook, B.C., Macleod and Calgary, Alta.), 994 miles; Coutts, Alta. to Dawson Creek, B.C., 870 miles.

Construction of the Alaska Highway through Canada was commenced in March, 1942, and the pioneer road was completed by November of the same year. The work was undertaken by United States Army Engineers. The road was developed into a military highway in 1943 with the aid of civilian contractors. Its total length from Dawson Creek, B.C., to Fairbanks, Alaska, is 1,523 miles, of which 1,221 miles are in Canada and 302 miles in Alaska. The highway follows generally the air route through the region, and access roads connect it with airports along the Northwest Staging Route. Under the terms of the agreement governing its construction, the highway was maintained by the United States authorities as a military road until April 1, 1946, when it was turned over to Canada.

The Alaska Highway has a gravelled, all-weather surface from Dawson Creek, B.C., through British Columbia and Yukon Territory to the Yukon-Alaska boundary, and is kept open to traffic throughout the year. The highway is being maintained by the Northwest Highway System (Canadian Army) and information on the current condition of the highway may be obtained at any time from The Commander. Northwest Highway System (Canadian Army), Whitehorse, Yukon Territory.

To facilitate maintenance operations on the highway, and for the benefit of travellers without automobiles, buses are operated on the Alaska Highway between Dawson Creek and Whitehorse and between Whitehorse and Fairbanks by British Yukon Navigation Company. Persons travelling by bus over the route are accommodated overnight at lodges operated by the bus companies. Information concerning bus schedules and fares may be obtained from the British Yukon Navigation Company at Whitehorse, Y.T.

The Canadian Government has prepared public camp-grounds for use by travellers without charge, at several locations along the Alaska Highway in Yukon Territory. These camp-grounds are intended for the

convenience of travellers equipped for camping, who carry their own food and supplies. In addition to an area for the erection of tents, etc., the camp-grounds provide cooking and dining shelters containing stoves and tables. The use of trailers and cabin trailers is permissible on the highway. However, the use of heavy trailers in conjunction with passenger cars is not recommended, owing to difficulties that might be encountered on some of the longer grades.

Permits to travel on the Alaska Highway are no longer required but the traveller must be prepared to satisfy the Canadian Customs at the port of entry that he has in his possession, or can readily obtain in Canada, sufficient funds for the proposed journey; also that his vehicle and other items of his equipment are capable of carrying him to his destination.

Additional information concerning the Alaska Highway, including roadside accommodation and facilities, and administration of natural resources along the right of way, may be obtained from Northern Administrations, Department of Resources and Development, Ottawa.

TOURIST ATTRACTIONS

YUKON offers many attractions to the visitor. It is a land of contrasts —in climate, in physical characteristics, and in human interest. Its romantic history, so intimately associated with the feverish days of the Klondike gold rush and the "Trail of '98", is recalled by visits to places made famous in prose and poetry. Snow-capped mountains, beautiful lakes, and majestic rivers that flow for hundreds of miles provide an everchanging panorama that is both interesting and delightful.

For those making use of water and railway transportation, the main points of departure for the Yukon are Vancouver and Victoria, B.C., and Seattle, Washington. Commodious, well-appointed vessels operated by Canadian and United States steamship companies provide, in normal times, a frequent service from these points to Skagway, following the famous "Inside Passage" for about 1,000 miles along the coasts of British Columbia and Alaska. In transit, calls are usually made at Alert Bay and Prince Rupert, British Columbia, and at Ketchikan, Wrangell, and Juneau, Alaska.

From Skagway, the White Pass and Yukon Railway follows one of the routes of the early gold-seekers up a deep gorge in the Coast Mountains to the summit of White Pass, situated on the boundary between Alaska and British Columbia. From the summit the railway descends by easy grades to Lake Bennett, and skirts its eastern shore northerly across the interprovincial boundary into Yukon Territory. The first large settlement reached in Yukon is Carcross, 68 miles from Skagway. From Carcross the railway continues for another 42 miles to Whitehorse, metropolis of Yukon.

At Carcross tourists may book passage on the steamer *Tutshi* for an overnight trip on Tagish Lake and West Taku Arm to the resort of Ben My Chree. Further details concerning this service will be found on page 20.

From Whitehorse a variety of excursions may be made. Among the most popular is the trip by steamer down the Lewes and Yukon Rivers to Dawson, a distance, one way, of about 425 miles. This trip, on which stateroom accommodation is provided by the British Yukon Navigation Company, Limited, is available at frequencies of about ten days during the season of navigation. The route is that followed by thousands of would-

be miners on their way to the Klondike. It touches many well known places such as Lake Laberge — setting of one of Robert Service's most famous poems — the Five Finger Rapids, and Fort Selkirk, first trading post in Yukon. If desired, the return trip may be made to Whitehorse by air.

In the immediate vicinity of Whitehorse, roads lead to the airport, one of the largest in northwestern Canada, Whitehorse Rapids, and Miles Canyon on the Lewes River.

Bus trips to Fairbanks, and Dawson Creek, as well as to intermediate points, may be made from Whitehorse, with the option of return by air line. Combination trips involving ocean-going vessel, railway, bus line, and river steamer, to points in Yukon and Alaska, may also be arranged. Further information on such outings may be obtained on application to the White Pass and Yukon Route, 407 Douglas Building, Seattle, Washington, or to the company's offices in Vancouver, British Columbia; Skagway, Alaska; or Whitehorse, Yukon Territory.

Dawson, gateway to the famous Klondike placer mining field, has many attractions. Several of the former hotels and dance-halls that catered to the miners in the early days of the mining industry are still standing, and form an interesting link with the past. Sightseeing trips up the Klondike River Valley to placer workings may be made, and modern mining operations with hydraulic dredges inspected. From "Midnight Dome" one can view, in a vast panorama, the headwaters of most of the creeks which have yielded, in the past 50 years, more than $200,000,000 in gold.

For tourists with limited time at their disposal air services provide a rapid and comfortable means of visiting Yukon Territory. Flights to Whitehorse are operated daily, except Sunday, from Vancouver and Edmonton by Canadian Pacific Air Lines. The route to Yukon follows in part that of the Alaska Highway, which may be seen threading its way through the mountains and along the rivers of Canada's vast northland. The company provides stewardess service in flight, and staff-houses operated at Fort St. John, British Columbia, and Whitehorse, offer attractive accommodation and dining-room facilities for passengers.

From Whitehorse visitors may take advantage of services to Fairbanks, Mayo, and Dawson, which are operated twice weekly.

Combination trips, employing air services to and from Yukon Territory and other means of transportation within the Territory, permit tourists to visit many places of interest within a limited space of time.

Additional information concerning points of tourist interest in Yukon Territory may be obtained by writing to the Commissioner, Yukon Territory, at Dawson, or the Territorial Agent, Whitehorse, Yukon Territory.

PHYSICAL FEATURES*

YUKON is a region of hills and mountains separated by a network of large valleys. The main feature of the Territory is a great basin-like area called the Yukon Plateau which is drained by the Yukon River and walled in on the north, east, and southwest by mountains. A large basin-like area drained by the Porcupine River lies to the north, and another drained by the Liard River lies to the southeast. The mountain barriers around these basins include the St. Elias and Coast Mountains

Contributed by H. S. Bostock, Geological Survey of Canada.

in the southwest and the Mackenzie Mountains on the east. Southwest of the Mackenzie Mountains and separating them from the Yukon Plateau, the Selwyn Mountains form a group of ranges along the divide between the Yukon and Mackenzie Rivers. The Ogilvie Mountains, extending westward from the northwest end of the Selwyn Mountains, form the watershed between the Yukon River and the Peel and Porcupine Rivers. To the north the basin of the Porcupine River is separated from the Mackenzie River and the Arctic Ocean by the Richardson and Buckland Mountains, for which the Arctic Plateau forms a sloping foreland stretching down to the ocean. Little is known of these mountains and the basin of the Porcupine River.

Northeast of the Yukon Plateau, the Mackenzie Mountains form a barrier of ridges similar in structure to those of the Rocky Mountains, from which they are separated by an area of plateau and plain country along the valley of the Liard River. A lofty section is situated near the headwaters of the Snake River, a tributary of the Peel River, where peaks close to 10,000 feet high are reported. The Selwyn Mountains hold the same relative position to the Mackenzie Mountains that Selkirk, Cariboo, and associated ranges in the south hold to the Rocky Mountains. The Ogilvie Mountains have a similar structure, but their peaks are not known to be more than 8,000 feet high, and no glaciers have been found in them.

The Yukon Plateau contains the best known and most developed part of the Territory. It is an area of rolling uplands whose summits show marked uniformity of elevation over broad expanses, representing an old erosion surface, now an upland surface. In many places this surface is interrupted by isolated mountains and ranges, among which are the Dawson, McArthur, Glenlyon, Big Salmon, and Pelly Mountains. These mountains have few peaks more than 7,000 feet in elevation. A broad warped depression in the surface of the upland follows the central northwest line of the plateau. A network of main valleys is deeply trenched from 1,000 to 2,000 feet below the upland surface. The valleys of the main rivers spread out in a great branching system connected by similar large valleys occupied by small streams. Several great valleys trend northwestward through the plateau, followed in different parts by various major streams. The greatest of these valleys, Tintina Valley, extends through the Territory from the Hoole River to the Yukon River and northwest to Dawson. This valley is occupied in part by the Pelly, Stewart, Klondike, and Yukon Rivers. Another great valley — Shakwak Valley — extends from Kusawa Lake northwest along Kluane Lake, thence across the International Boundary. To the northwest the plateau extends on into Alaska. Although broken by mountain ranges it extends southeastward to the Stikine Plateau of British Columbia. To the southwest the plateau slopes upward and abuts against the Coast Mountains.

The Coast Mountains in Yukon Territory are the northward extension of the Coast Mountains of British Columbia and have all the characteristic roughness of the latter. In Yukon, however, the elevations seldom exceed 7,500 feet, and they slope northwestward, terminating near Kusawa Lake. The front ridges of the St. Elias Mountains rise abruptly to 7,000 feet or more, and are separated from the main ranges by a belt of plateau-like country. The main ranges of the St. Elias Mountains then rise southwestward to a vast plateau of snow and ice, out of which great valley glaciers extend their tongues, and above which stand these great peaks: Mount Craig, 13,250 feet; Mount Wood, 15,880 feet; Mount Walsh, 14,780 feet; Mount Vancouver, 15,720 feet; Mount Steele, 16,439

feet; Mount Lucania, 17,150 feet; Mount St. Elias, 18,008 feet; and Mount Logan, 19,850 feet, the second highest peak in North America. There are also many other unnamed peaks having elevations of 10,000 feet and more above sea-level. On rare days the great peaks can be seen from prominent elevations hundreds of miles away, dazzlingly white in their almost complete mantle of snow and ice, and appear to float like clouds above the denser and hazy atmosphere below.

As they approach the 60th parallel the St. Elias Mountains are intersected by a sharp depression which is followed by the Alsek River, the only stream from Yukon flowing directly to the Pacific Ocean. This river, which rises in an area of spreading valleys on the northeast slope of the St. Elias Mountains and in the plateau, turns south into a great gorge partly blocked by glaciers, and, although it contains no great single cataract, drops over 1,500 feet in its 80-mile journey to the sea.

The Yukon River has played a vital part in the development of the Territory, although only the upper reaches of the mighty stream are contained within the territorial boundaries. The volume of the Yukon River is less than that of many other rivers of the same length elsewhere in the world, owing to the semi-arid climate of most of the region which it drains. Its heads, rising in the mountains, gather volume and descend quickly, at first, but lose their gradient as they come into the plateau. This has resulted in the formation of an amazing branching system of navigable waterways. From Whitehorse, situated only 110 miles by rail from the ocean port of Skagway on the Alaskan Coast, a river steamer more than 200 feet long and carrying several hundred tons of freight may navigate without interruption by rapids to the Bering Sea. Within Yukon Territory smaller steamers have navigated more than 1,400 miles of this river system, and a still greater mileage of smaller streams is navigable for suitable power-driven river boats.

The semi-arid climate of the Yukon Plateau extended far back through the Pleistocene Era and prevented the ice sheets, which blanketed nearly all the rest of Canada, from covering its northwestern part. To this factor may be attributed the general lack of lakes in the interior and northern parts of Yukon Territory. The larger lakes which do exist are found within or close to the mountains, and are renowned for their beauty.

GENERAL GEOLOGY*

THE main physical features of Yukon Territory mentioned in the previous section are in a broad way geological units and form a suitable basis for the description of the geology. The Yukon Plateau occupies a central position. It is constructed on a well-exposed foundation of crystalline rocks, mainly old metamorphic strata of Precambrian and Palæozoic ages and younger intrusions. Tertiary lavas and sediments lie in scattered patches on its surface. In the southeast a broad trough in the foundation is occupied by a thick section of folded Mesozoic strata. On the east the surface of the crystalline foundation is depressed and the older metamorphic rocks are in most places overlain by folded and faulted late Palæozoic and Mesozoic strata.

Geological information concerning the interior of the St. Elias Mountains is very limited. Its great peaks are reported to be of granitic rocks,

**Contributed by H. S. Bostock, Geological Survey of Canada.*

but along its northeastern border, Palæozoic and Mesozoic strata form the front ranges. The plateau-like belt between the front ranges and the main ranges is largely occupied by Tertiary sediments capped by volcanic rocks. The Coast Mountains to the southeast are formed of granitic intrusions with roof pendants of old metamorphic rocks and Mesozoic strata of the Yukon Plateau.

To the northeast of the plateau the Selwyn Mountains are composed of a great thickness of folded and faulted sediments ranging from Precambrian to Tertiary in age, but in many sections, notably in the northern flanks, long periods of Palæozoic and Mesozoic time are not represented. These mountains also contain considerable areas of granitic intrusive rocks that swell to batholithic dimensions east of Frances Lake. Farther east the Mackenzie Mountains appear to be wholly of sedimentary rocks.

Little is known of the Ogilvie Mountains except that they are composed mainly of Palæozoic and Mesozoic sedimentary rocks associated with small intrusions and with areas of Precambrian rocks in their southwest part.

To the north the Richardson and Buckland Mountains are composed of upfolded Palæozoic and Mesozoic strata. Some intrusions have been found in the Buckland Mountains, but none is known in the Richardson Mountains. The broad basin of the upper part of the Porcupine River contains a wide expanse of flat-lying strata believed to be mainly Mesozoic sediments. Old Crow Range is a ridge of Palæozoic and perhaps Precambrian rocks, with granitic intrusions. To the south of it areas of Tertiary strata lie along the Porcupine River, and, to the north, another large basin-like area of flat lying rocks, perhaps of Mesozoic or Tertiary age, extends toward the Buckland Mountains.

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CLIMATE*

GREAT variations in temperature from year to year are characteristic of the climate of Yukon Territory. In some years the coldest month has averaged from 40 to 50 degrees below zero F., and in other years it may have had an average temperature above zero.

The geographical location of Yukon is one of the reasons for these variations in weather. Since the Territory extends latitudinally from the relatively warm Pacific Ocean to the cold Arctic Ocean it is difficult to generalize on the climate of the whole region. When cold air masses from the Arctic Ocean north of Alaska and Siberia move over Yukon, temperatures are very low and remain low while the air masses stagnate over the region. On the other hand, if these cold air masses enter the North American Continent to the eastward, passing up the Mackenzie Valley, Yukon comes under the influence of northward moving air from the North Pacific Ocean, and winter temperatures may, therefore, be relatively mild. Depending upon the frequency and duration of these cold air mass invasions, winters will vary in intensity of cold from month to month and from year to year.

**Compiled from information supplied by the Meteorological Division, Department of Transport, Toronto, Canada.*

Similarly, summer temperatures vary according to the predominant air mass movements. Days can be quite hot when air from the Pacific Ocean or Alaska is over Yukon, or be cool when arctic air invades the Territory. The duration of sunlight is long during the summer, which assists the warming process and aids garden growth. Dawson has almost 24 hours of daylight during late June and about 20 hours during July. At the same time, Whitehorse, farther south, has about 20 hours of daylight in June and about 18 hours in July. Conversely, winter days have only 5 to 8 hours when the sun is above the horizon.

Only a few weather stations have long periods of meteorological records, and these represent only valley conditions, but their averages indicate the general climatic conditions of the rest of the Territory. Mean monthly winter temperatures range from zero degrees in January at Carcross to –13 degrees at Mayo and –21 degrees at Dawson. An extreme minimum temperature of –81 degrees was recorded at Snag airport in February, 1947. Summer, characterized by warm days and cool nights, has monthly average temperatures of 50 to 60 degrees. Daily maxima usually reach 80 to 85 degrees sometime during the month, and a temperature of 95 degrees at Dawson is the highest yet recorded in Yukon.

Killing frosts may occur in any month of the year, but are rare in July. Southern Yukon, with higher elevations, has a frost-free period of about 45 days, while Dawson, in west central Yukon, has an average of 75 days without frost. In general, the average last spring frost occurs in mid-June and the average first autumn frost is recorded in mid-August. The first autumn frost has always been recorded before September 15 at all Yukon stations.

Annual precipitation is low in Yukon, due mainly to the high barrier of the St. Elias Mountains on the south which cuts off moisture from the Pacific. An average of 9 to 13 inches of precipitation is recorded during the year. Of this 35 to 50 per cent is rain which falls during the four summer months. From $1\frac{1}{2}$ to 2 inches of rain per summer month is typical. Snowfall occurs most frequently from November to January, when an average of about 10 inches of snow may be expected monthly. Lesser quantities fall in October and March, and some snow may be expected in April, May, and September.

ABORIGINES*

THE native inhabitants of Yukon Territory are Indians and Eskimos. The Indian population was estimated in 1948 to be about 1,585. In addition there are now twelve families of Eskimos numbering approximately seventy persons living on Herschel Island.

Indians

The Indian inhabitants of Yukon may be divided into two principal groups, the Déné or Athapascans who inhabit the interior, and members of the Tlingit tribe who occupy the southwestern part of the Territory.

The Déné people may be again subdivided into two main groups. The first of these is the Loucheux tribe, occupying the drainage systems of the

**Contributed by J. D. Leechman, National Museum of Canada.*

Peel and Porcupine Rivers. Their principal settlement is at Old Crow. South of these people, and occupying the drainage system of the Yukon River, are the Kutchin Indians. These people are often referred to as "Stick" Indians; a term meaning "forest," taken from the Chinook jargon, now no longer used in Yukon.

To the south of these Kutchin people and occupying the drainage of the Alsek, the Tatshenshini, and other rivers flowing into the Pacific Ocean, are several small groups of people who, though of Kutchin origin, have intermarried with the Tlingits and have adopted much of their language, and who depend in large part on the migrating salmon which mount these streams to spawn.

The Tlingit Indians of the coast were for many years in the habit of conducting annual trading expeditions into the interior. They frequently terrorized the Déné people and in 1852 looted the Hudson's Bay Company post at Fort Selkirk.

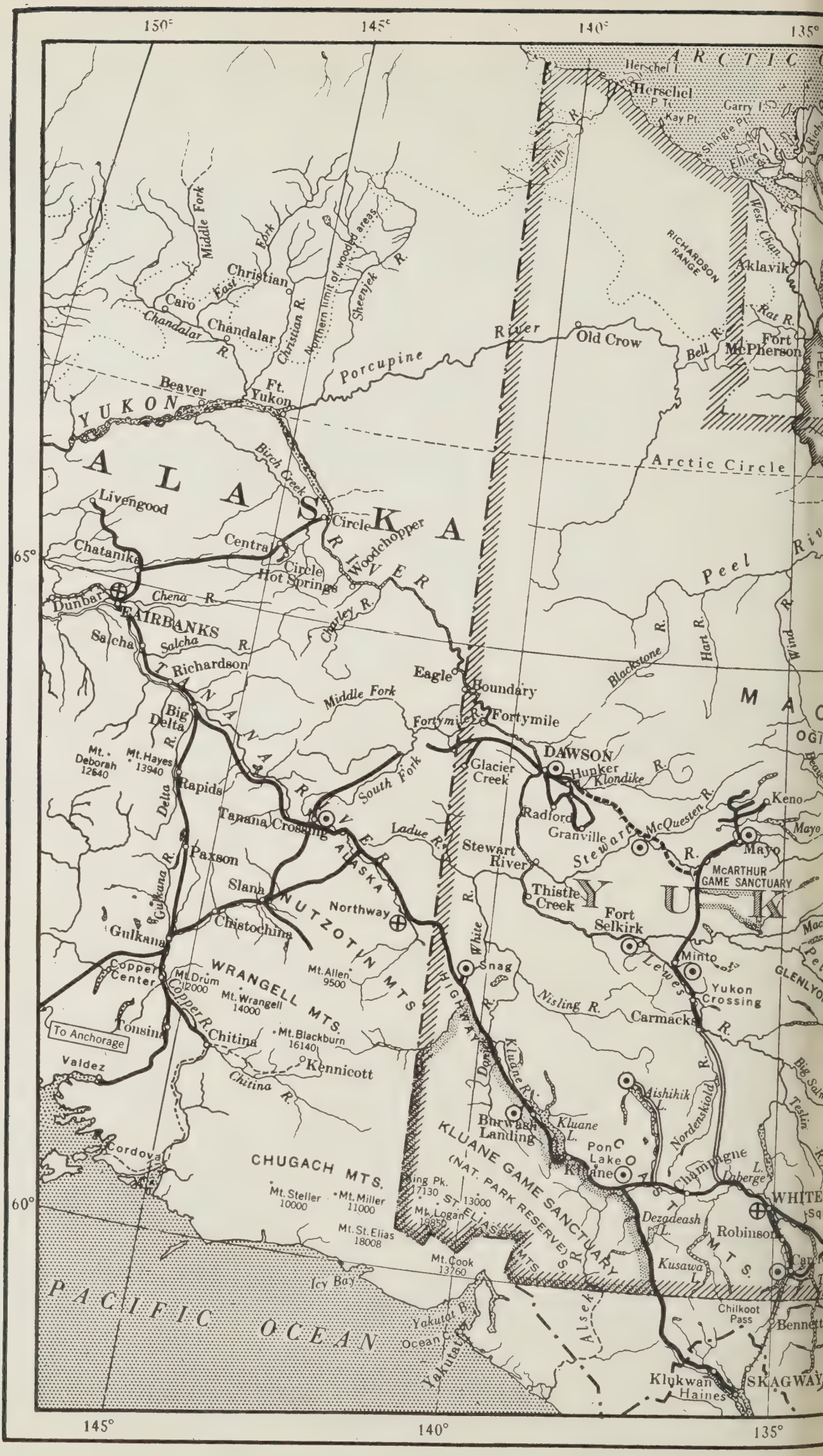
In the southeastern corner of Yukon Territory, in the neighbourhood of Frances Lake and the streams draining into the Liard River, is a small group of Nahanni Indians.

Before the arrival of Europeans in Yukon the native inhabitants depended on the products of fishing and hunting for their livelihood. The Eskimos followed a mode of existence in no way different from that of their neighbours along the Arctic Coast to the east and west. The large body of Déné Indians, occupying most of the interior, hunted the moose and cariboo, the black and grizzly bear, and mountain sheep, and ate large numbers of smaller animals such as hares and gophers, as well as fish. For vegetable food they used berries and a few roots of plants. Their clothing was of smoke-tanned cariboo skin and their principal weapon was the bow. Snares were used extensively for small game as well as for bears, and moose were driven along specially constructed fences into ambush. Transportation was by means of canoes of birch bark or of skin stretched on wooden frames in summer, and by toboggans in winter. Both dogs and people frequently carried packs. Snowshoes were used extensively in winter.

Recent archæological work in the southwest part of Yukon has revealed stone tools at such a depth underground as to indicate a very considerable antiquity. This early stone culture has not yet been correlated with other archæological cultures, but preliminary work seems to suggest a connection with Siberia and southwestern United States.

Since the arrival of white residents there has been a great change in the condition of the native population. In the southern part of the Territory and along the Yukon River many white men have married Indian women and a large number of people of mixed blood are now seen. Native clothing has disappeared almost entirely except for moccasins and the skin parka, and the Indians of the younger generations are adopting white habits very rapidly. Many of them speak good English, have their own cars, and are quite efficient at handling complex machinery, several having been engaged to operate bulldozers while the Alaska Highway was being constructed.

The people in the south, who show such strong Tlingit influence, represent a particularly fine type of Indian, — frank, sincere, and intelligent, reminding one of the Eskimo rather than the typical Indian of the Northwest Territories.


150°
145°
140°
135°
65°
60°
ARCTIC
Herschel I.
Herschel
Pt.
Kay Pt.
Garry I.
Shingle Pt.
Ellice R.
Firth R.
Middle Fork
East Fork
Christian
Christian R.
Northern limit of wooded areas
Sheenjek R.
Caro
Chandalar
Chandalar R.
RICHARDSON RANGE
West Chan.
Aklavik
Rat R.
River
Old Crow
Bell R.
Fort McPherson
Porcupine
Beaver
Ft. Yukon
YUKON
ALASKA
Arctic Circle
Birch Creek
Livengood
Circle
Woodchopper
Centra
Chatanika
Circle Hot Springs
Dunbar
Chena R.
FAIRBANKS
Charley R.
Peel R.
Salcha
Salcha R.
Richardson
Eagle
Boundary
Blackstone R.
Hart R.
Middle Fork
Fortymile R.
Fortymile
Big Delta
Mt. Deborah 12540
Mt. Hayes 13940
Rapids
Delta R.
DAWSON
Hunker
Klondike R.
Glacier Creek
South Fork
Tanana Crossing
Radford
Granville
McQuesten R.
Keno
Mayo
Ladue R.
Stewart River
Stewart R.
Paxson
Gulkana R.
Slana
NUTZOTIN MTS.
Northway
McARTHUR GAME SANCTUARY
Thistle Creek
YUKON
Fort Selkirk
Gulkana
Chistochina
White R.
Snag
Minto
Lewes
Yukon Crossing
Copper Center
Mt. Drum 12000
Mt. Wrangell 14000
WRANGELL MTS.
Mt. Allen 9500
Nisling R.
Carmacks
Tonsina
To Anchorage
Copper R.
Chitina
Mt. Blackburn 16140
Kennicott
Valdez
Chitina R.
HIGHWAY
Dorsey R.
Kluane R.
Mishihik L.
Nordenskiold R.
Big Salmon
Teslin
Burwash Landing
Kluane L.
Pon C Lake
Kluane
Champagne
Aishihik L.
Cordova
CHUGACH MTS.
KLUANE GAME SANCTUARY
(NAT. PARK RESERVE)
Mt. Steller 10000
Mt. Miller 11000
King Pk. 17130
ST. ELIAS MTS.
13000
Mt. Logan 19850
Mt. St. Elias 18008
Dezadeash L.
Robinson
WHITE
Kusawa L.
Mt. Cook 13760
Icy Bay
PACIFIC OCEAN
Yakutat Bay
Ocean C.
Yakutat
Alsek R.
Chilkoot Pass
Bennett
Klukwan
Haines
SKAGWAY


CANADA
DEPARTMENT OF RESOURCES AND DEVELOPMENT
NORTHERN ADMINISTRATIONS
1950
MAP OF
THE YUKON TERRITORY
SCALE
Miles 50 0 50 100 Miles
REFERENCE
Yukon Boundary
Highways
Secondary Roads
Winter Roads
Railways
Airports (Licensed)
Other Airports, Aerodromes and Landing Fields
130°
125°
120°
115°
65°
60°
Stanton
Anderson
Thunder R.
Iroquois
Loon R.
Fort Good Hope
Hare Indian R.
Ramparts
Ramparts R.
NORTHWEST TERRITORIES
MACKENZIE
MOUNTAINS
Norman Wells
Carcajou
Site of Camp Canol
Gr. Bear R.
Ft. Norman
Fort Franklin
Russel B.
Keith Arm
GREAT BEAR
Grizzly Bear Mtn 1500
McVicar Arm
Hottah L.
Etacho Pt.
Pt. Leith
Richardson I.
Conjurer B.
2144'
191'
Hardisty L.
L. Ste. Therese
L. Taché
L. Grandin
Lac la Martre
NORMAN RANGE
Blackwater L.
Mt. Eduni 7100
Keele River
SAYUNEI RANGE
TIGONANKWEINE RANGE
SELWYN RANGE
Keele Pk. 8500
6500
Mt. Christie 7300
Wrigley
Greasy L.
Highland L.
Root R.
N. Nahanni R.
Willowlake R.
Willow L.
Camsell Bend
Mt. Camsell
Nahanni Mtn.
Fort Simpson
MACKENZIE RIVER
Sheldon L.
South Nahanni R.
Virginia Falls 316'
Flat R.
Traffic Mtn. 6000
Ross R.
River
Trout R.
Trout L.
Frances L.
Site of Fort Frances
Liard R.
Hyland R.
Frances R.
Wolf L.
Fort Liard
LIARD RIVER
Beaver R.
Petitot River
Coal R.
Watson Lake
Pine Lake
Smith R.
Lower Post
ALASKA
HIGHWAY
Nelson Forks
Fort Nelson
Liard River
Kotcho L.
Sahtaneh R.
Nelson R.
Fort Nelson R.
BRITISH COLUMBIA

Eskimos

Archæological remains indicate that the short Arctic Coast of Yukon (about 135 miles) once supported a considerably larger population of Eskimos than it does today. A Royal Canadian Mounted Police post is maintained at Herschel Island. The Anglican Mission settlement at Shingle Point was moved to Aklavik in 1936, shortly before the point itself was swept away by violent storms. Habitable cabins still stand at Kay Point, Herschel Island, and Demarcation Point. Good shelter for small boats may be found in a cove about 8 miles northwest of Shingle Point. Eskimos from Alaska travel the coast frequently, on the ice in winter and by boat in summer, on their way to and from the Mackenzie Delta, but travellers cannot rely on finding any people or assistance here. During the winter Eskimos still go inland to the Richardson Mountains in pursuit of caribou.

Indian Administration

The administration of Indian affairs in Yukon Territory is carried out by a resident Indian Agent at Whitehorse, under the direction of the Indian Affairs Branch, Department of Citizenship and Immigration, at Ottawa. The Indian welfare program in the Territory includes assistance in the provision of means of livelihood; education of Indian children; payment of treaty money; supervision of the payment of Family Allowances in kind; provision of relief rations to the old and physically incapacitated; and the furnishing of such supplies and equipment as circumstances may require.

Native-born Indians, Eskimos, and half-breeds are authorized under free permits to engage in hunting and trapping. An area of approximately 4,000 square miles in northeastern Yukon, known as the Peel River Native Game Preserve, was established in 1923 for the benefit of the native Indian and half-breed population, which has exclusive hunting privileges therein.

Medical care and hospitalization of Indians in the Territory is arranged by Indian Health Services of the Department of National Health and Welfare. Doctors resident in Dawson, Mayo, and Whitehorse serve as departmental medical officers on a part-time basis or are reimbursed for professional services. Indians requiring hospital care are admitted to the hospitals at Dawson, Mayo, and Whitehorse. The resident medical officers carry out protective inoculations and other public health measures and a full-time departmental nurse with headquarters at Whitehorse visits Indian settlements along the Alaska Highway as well as occasional visits to posts on the Yukon River system. There are field matrons or dispensers at Old Crow and Fort Selkirk, and the welfare teachers of the various schools interest themselves in the health of the children and their home environment. Regular surveys and X-ray clinics visit the settlements making use of various means of transportation and urgent cases are tended through liberal use of aircraft.

The Indian Affairs Branch has had an educational survey made of the Territory, and, as a result, new schools are being built or are planned. Indian Day Schools are operated by the Indian Affairs Branch at Whitehorse, Mayo, Moosehide (Dawson), Carmacks, and a joint school is in operation at Teslin. An Indian residential school is operated by the Church of England at Carcross, and a private boarding school is subsidized at Whitehorse. A new residential school is planned near Teslin.

FLORA

Forests

THE forests of Yukon belong to the Boreal Forest Region of Canada, which is characterized by combinations of a small number of species as well as by a relatively slow rate of growth. Especially is this true of the forest along its northern border where the full effect of latitude is obvious. Although Yukon Territory south of latitude 65° North may be classed as forested country, its general elevation is fairly high and the combined effect of altitude and latitude limits tree growth over much of the area to stands of little or no commercial value. The absolute timber-line ranges from about 5,000 feet above sea-level in the south to about 4,000 feet or less at latitude 65° North, and the limit of merchantable growth is situated at least 1,500 feet below the timber-line. Consequently, conditions over practically the whole of Yukon are such that timber cannot grow to merchantable size, except in the major valleys and depressions.

White spruce is the most common species occurring in Yukon and makes up the bulk of all important stands. In the Liard River watershed there are excellent bottom-land stands of white spruce. Elsewhere, especially along the valleys of tributaries of the Yukon River which rise in the Mackenzie Mountains, bottom-land stands of merchantable timber occur frequently. White spruce also is the most common species found on the uplands. Here, however, it is usually of poor quality and occurs most frequently in pure stands of widely-spaced, branchy trees of poor height.

Aspen poplar, balsam poplar, and birch are also common, and usually occur as mixed stands along with spruce. However, as these species are confined mainly to well-drained uplands, they seldom attain sawlog size, but nevertheless are useful as fuel-wood where supplies of spruce are not available. Lodgepole pine occurs in pure stands in the southern part of the Territory, where it is useful as fuel-wood and for the manufacture of ties and poles. Alpine fir is found in that part of Yukon east of the Lewes and Yukon Rivers, but because of its poor quality and inaccessible location it is not commercially important. Black spruce and tamarack also occur in limited quantities.

As a result of recent surveys it is believed that a good supply of merchantable timber suitable for sawlog material may be found in those parts of the Territory situated south of latitude 61° North, and east of the Lewes and Yukon Rivers as far north as latitude 65° North. It is probable that the rate of growth is such that these areas could continue to supply all local needs and even provide an exportable surplus for use in the drier and less well-timbered western and northern parts of Yukon. The only area that might be called upon to supply areas outside Yukon Territory is the valley of the Liard River in the southeast corner.

For about 30 years after the gold rush of 1898 nearly all lumber used in Yukon Territory was of local manufacture. Sawmills operated at Dawson and other points along the Yukon River supplied the lumber used in the construction of buildings in Dawson, as well as the large quantity required for the construction of flumes and sluice boxes necessary for the mining industry. These operations have practically exhausted the supply of timber suitable for sawn lumber in the area close to the Yukon River, and since 1930 the lumber requirements of Dawson and Whitehorse have been supplied largely by shipments from British Columbia.

Several sawmills are operated in Yukon Territory. Two mills situated at Mayo are equipped to manufacture practically all types of lumber required for building purposes. A small sawmill is operated at Dawson, and others have been in operation at points along the Alaska Highway. Practically all lumber is sawn from white spruce logs. Although native timber is used in the construction of small boats and scows, all steamboats and barges operating in Yukon are constructed of imported lumber.

White spruce and birch are used extensively as fuel, and poplar is substituted where these species are not available. In the southern part of the Territory jackpine is plentiful and forms an important fuel supply. Wood is used as fuel in all steamboats operating on the Yukon River and its tributaries, and over a period of 45 years or more a very large quantity has been consumed. The average consumption of an ordinary river steamboat for a round trip from Whitehorse to Dawson is 150 cords.

In the early days of mining, frozen areas to be worked by placer dredges were first thawed by steam, and considerable timber along the Klondike and Yukon Rivers was used as fuel in these operations. Much wood was also burned by miners in thawing gravel to be worked in sluice boxes and rockers.

Forest reconnaissance surveys were carried out in southern Yukon and along the Lewes, Stewart, and Yukon Rivers and on the Alaska Highway in 1943 and 1944 by forest officers of the Department of Mines and Resources. Much information about forest conditions was obtained. As a result, a Forest Protective Service, headed by a forest engineer with headquarters at Whitehorse, was organized. For the present, forest protection is being confined to areas adjacent to the main arteries of travel i.e. the Alaska Highway, the Haines Cut-off, and the Lewes-Yukon river system. The officer in charge assists the Crown Timber and Dominion Lands Agent at Whitehorse in the administration of timber and public lands.

Wild Flowers

Yukon is a land of flowers. They grow wild almost everywhere, and in great profusion. They are a constant source of delight to the visitor, for their luxuriance, colour, and fragrance give an additional touch of beauty to many a lovely scene. Wild flowers grow in the valleys and on the lower slopes, and even on the higher spaces above timber-line will be found the hardier species that refuse to be beaten back by the temperature and the elements. Nearly 500 varieties of wild flowers, ferns, and shrubs have been identified in the Territory.

Wild flowers in Yukon are principally blue, pink, and magenta in colour, with a generous touch of yellow in a number of species. Strangely, deep scarlet flowers are rare, and species such as Indian paint brush that farther south range in shade from brick-red to cherry, appear in Yukon in lemon and magenta shades. Characteristic species include arnica, shrubby cinquefoil, marsh marigold, yellow pond lily, Arctic poppy, mustard, yellow violet, vetch, goldenrod, Drummond's dryas, locoweed, stonecrop, hawkweed, and monkey flower. The ubiquitous dandelion is found in Yukon, as is also the eastern buttercup.

From early spring, when the dainty pasque flower — known locally as the purple crocus — pushes its head above ground, until the last faded leaves of autumn have fluttered down, a constant variety of floral beauty embellishes the countryside. By June the landscape is carpeted with purplish blue lupin, broken here and there by the Arctic poppy and Jacob's ladder. On the higher slopes are the mountain forget-me-not, mountain

harebell, and brilliant cerise shooting star. Lower down grow the wild rose, Dutchman's breeches, bleeding heart — a tiny prototype of the cultivated variety — and many other species that flourish during the long hours of summer daylight.

Among the distinctive flowers of the Yukon are several varieties of the orchid family. The most common is a large purplish pink blossom with white spots. It grows on sunny exposed slopes, as well as in shady damp woods. Occasionally a pure white orchid is disovered, an exquisite single flower exhaling a faint but delicate fragrance. Within a few minutes' walk of Dawson will be found the fragrant bog orchid, fly-spotted orchid, dainty coral-root, ladies' tresses, and calypso.

By late July, distant hills and mountains, roadsides, and borders of trails are coloured by the gorgeous magenta-purple of the fireweed, presaging the coming of autumn. Later, as trees and shrubs change colour, Nature adds a final touch by painting the countryside in brilliant shades of scarlet and gold — a closing pageant before the first crystalline flakes of snow begin to fall.

FAUNA

Mammals

ONE of the important natural resources of Yukon Territory is mammalian wildlife, which includes varieties of big game such as mountain sheep, mountain goat, moose, caribou, and bear, as well as numerous fur-bearers. The most widely known big-game districts are a large area extending northward from Kluane Lake to the upper White River, including the Donjek River, part of which now lies within Kluane Game Sanctuary; the region adjacent to Teslin Lake in southeastern Yukon; and areas in the vicinity of the Big Salmon, Macmillan, Ross, and Stewart Rivers. Game is also found in the area bounded by the Yukon, Porcupine, and Peel Rivers.

Mountain sheep in Yukon are of the Dall variety. They are more slender than the Rocky Mountain or "bighorn" sheep and vary in colour, according to locality, from pure white to almost black. Two of three subspecies occur in Yukon as follows:

Dall Sheep, nearly pure white, are found principally in the northern and southwestern parts of the Territory. They range south from the Richardson Mountains to the Ogilvie Mountains, and in the St. Elias Mountains. In central Yukon they intergrade with **Stone Sheep.**

Stone Sheep, dark brown, with underparts, rump, and face white, range from the Cassiar Mountains of British Columbia north to the Pelly River. They intergrade with **Dall Sheep** in the northern Cassiars and in the Pelly Mountains.

Intergrades that are white sheep with dark saddles were at one time called **Fannin Sheep.** However, complete intergrading between the white Dall and the largely black Stone sheep has necessitated the view that Dall, Stone, and Fannin sheep represent only one species.

Mountain Goat, a white animal with black horns, hoofs, and nose, is found in the St. Elias Mountains and in parts of southern Yukon.

Mule Deer occurs in southern Yukon, but is rare.

Alaska Moose is one of the common big game species in Yukon, and is a principal source of food for native Indians in some localities. Heads of

specimens killed in Yukon having spreads of 65 to 70½ inches have been reported. Moose occur from southern Yukon north to the Porcupine River region, and are particularly common in the vicinity of the Macmillan River.

Barren Ground Caribou is also plentiful in Yukon. Two sub-species are recognized in the area. They include **Stone Caribou,** and **Osborn Caribou.** The former ranges over northern and western Yukon, and includes the great migratory herds that once ranged south from the Porcupine River to the Whitehorse and Kluane areas. The **Osborn Caribou** is found principally in southeastern Yukon.

Black Bear, including the brown phase or variety, occurs generally through the wooded sections of the Territory. In some parts of Yukon the brown phase predominates.

Grizzly Bear is fairly common in the Territory, although generally found in the less heavily timbered and more inaccessible regions.

Polar Bear occurs along the Arctic coastline of Yukon.

Timber Wolf is common. Subspecies found in Yukon include the **Tundra Wolf,** ranging from the Porcupine River north, and the **Alaska Wolf,** a larger form ranging over most of the area.

The **Bowhead Whale** and **White Whale** or **Beluga** occur off the Arctic Coast of Yukon. The **Pacific Walrus** is occasionally found off the Yukon Coast, as are various seals. Among the latter are the hooded seal, the bearded seal, the Beaufort ringed seal, and the Pacific harbour seal.

Fur-bearers which occur in Yukon include beaver, ermine (weasel), mink, marten, wolverine, muskrat, otter, lynx, and Arctic fox. Red fox, including the silver, cross, and black phases is also found. Snowshoe rabbit is abundant, and porcupine, pika or "rock rabbit", and northern hoary marmot or "whistler" are prevalent. Other forms of smaller wild animal life to be observed include red squirrel, Yukon ground squirrel and Arctic ground squirrel, flying squirrel, chipmunk, brown lemming, white lemming, pack rat, and several species of meadow mouse, tundra mouse, red-backed mouse, and white-footed mouse which form an important portion of the food of the carnivorous fur-bearing mammals.

Birds

Biological investigations carried out in Yukon at various times by qualified observers have disclosed an extensive and varied bird life. Many of the species found are year-round residents.

Among the game birds, the most abundant are grouse, ptarmigan, and some species of waterfowl. Dusky grouse, commonly known as blue grouse, is quite plentiful in some districts, and spruce grouse, sharp-tailed grouse, and ruffed grouse are also common. Willow ptarmigan is found near the timber-line in many districts, and rock ptarmigan and white-tailed ptarmigan occur above the timber-line.

Waterfowl that occur include wild goose, swan, and duck. The Canada goose breeds along the main tributaries of the Yukon River, and swans have been observed on the Pelly River and small lakes of the region. Species of duck which have been identified include American merganser, red-breasted merganser, mallard, baldpate, pintail shoveller, greater and lesser scaup, harlequin, and American and Barrow golden-eye. Wilson's snipe, northern phalarope, spotted sandpiper, black-bellied plover, and golden plover are also present.

Predatory birds found in Yukon include bald eagle, Richardson's owl, hawk owl, great grey owl, and snowy owl, goshawk, red-tailed hawk, sharpshinned hawk, and marsh hawk. Osprey is also found in some districts.

Common residents or migrants which occur also include the American robin, American raven, Canada jay, hairy and Arctic three-toed woodpecker, pine grosbeak, Bohemian waxwing, crossbill, horned lark, yellow warbler, mountain bluebird, common redpoll, hermit thrush, rufous hummingbird, Townsend's solitaire, black-capped chickadee, brown-headed chickadee, bank swallow, cliff swallow, tree sparrow, pine siskin, slate-coloured junco, Say's phoebe, and snow bunting.

Additional information concerning wild animal and bird life in Yukon Territory is contained in the publications "Mammals of Yukon" (Bulletin No. 100) and "List of Yukon Birds and those of the Canol Road" (Bulletin No. 105) which are available from the National Museum of Canada, Ottawa, at a cost of 25 cents per copy.

Fish

Several varieties of game fish occur in the lakes and streams of Yukon Territory. King, or "tyee", and dog salmon ascend the Yukon River and tributaries from Norton Sound, and provide a valuable fishery for the native Indian population, particularly in the vicinity of Dawson. A small number of the same species are found in the Porcupine River. Five species of salmon — king, humpbacked, sockeye, cohoes, and dog — ascend the Tatshenshini River, a tributary of the Alsek River, from the Pacific, and contribute to an important Indian fishery at Klukshu. Steelhead trout, a sea-going form of the famous rainbow, also ascends the Tatshenshini and tributaries in May.

Great lake trout and Nelson's whitefish are common to many of the larger lakes in southern Yukon, including Teslin, Tagish, Marsh, Laberge, Kathleen, Dezadeash, and Kluane. Least herring, or cisco, is plentiful in lakes near Carcross including Bennett and Tagish. Landlocked steelhead trout and sockeye salmon occur in the upper Alsek River watershed, presumably having been cut off from the sea by the formation of falls on the Alsek River.

Rainbow trout is plentiful in the Dezadeash and Alsek Rivers, and occurs in other streams accessible from the Alaska Highway. Dolly Varden trout is also caught in eastern Yukon Territory and in the Tatshenshini River. Arctic grayling or "bluefish" is abundant, and can be taken on a fly in most rivers. Other species which occur include inconnu, northern chub, northern pike, northern sucker, common sculpin, trout-perch, "tezra" or Mackenzie whitefish, and the rare Coulter's whitefish.

THE MINING INDUSTRY

THE presence of gold in the bars of streams feeding the Yukon River was first reported by officers of the Hudson's Bay Company in the 1850's, and later by a missionary stationed in the vicinity of Fort Yukon about 1862. Prospecting began in 1873 and fine gold was later discovered along most of the principal streams. By 1886 more than one hundred miners were working in Yukon, and gold to the value of thousands of dollars was recovered from Steamboat Bar on the Stewart River and Cassiar Bar on the Lewes River. By 1890 prospecting had spread to other

streams, including Fortymile River, where coarse gold was discovered. The Sixtymile River placer field was found in 1892, and by 1895 its annual production had reached a value of $250,000. This was the first area in Yukon in which the creek gravels were the chief source of gold, in contrast to the river bars, as on the Lewes, Stewart, and Fortymile Rivers.

The smaller streams then became a field for prospecting and in August 1896, the famous Klondike placer creeks were discovered. Their amazing richness attracted miners from other parts of Yukon, and most of the better creeks of the district were quickly staked, while those of other areas, including Sixtymile, were deserted. The strike also attracted thousands of prospective miners who made their way to the Klondike, and in the next ten years prospectors had covered the entire region. It was during this period that nearly all the known placer creeks in Yukon were discovered, and also the deposits of the Whitehorse copper belt, the Mayo silver-lead district, and the Carmacks coal basin. In addition, ores of gold, antimony, tungsten, zinc, arsenic, manganese, and iron were found in lode deposits, and tugnsten, mercury, tin, platinum, and bismuth were found in placers.

Placer Mining

The climate and the nature and richness of the gold placers at first favoured hand methods of mining with the result that each claim soon became a productive mine in itself. The output of gold rose rapidly and in 1900 it reached a peak value of $22,275,000. By 1906 most of the rich, easily-mined ground was worked out, and in 1907 the value of gold production declined to $3,150,000. The introduction of dredging in 1905, followed by an amalgamation of interests, resulted in increased placer production during the next few years, until in 1913 it reached a value of $5,846,780, an amount that has not since been exceeded. The gradual exhaustion of the richer hydraulic and dredging grounds lowered the value of production to $1,243,287 in 1923, and from then until 1932 the annual production was valued at less than $1,000,000.

In 1932 a change of policy and management took place in Yukon Consolidated Gold Corporation, which had acquired practically all the reserves of the Klondike district. The possible reserve areas were explored and a development program lasting several years was undertaken. Prospect drilling proved the presence of huge reserves of pay gravels, including a virgin channel several miles long, which extended under the cabins of old-time miners who did not know of its existence. The rise in the price of gold quickened the revival of placer mining that followed improvements of method, organization, and mechanical equipment, and by 1939 the value of annual production had increased to more than $3,000,000. This figure was maintained from 1940 to 1942, but in 1943 labour shortages resulted in fewer dredges being operated and restricted production to $1,584,660. Gold production for 1944 declined to a value of $916,993, but by 1948 it had risen to over $2,000,000.

No separate records have been kept of the placer gold output of the other districts. The Sixtymile camp, which includes Miller, Glacier, and other creeks, as well as Sixtymile River, has been worked continuously for over fifty years. The introduction of modern dredging equipment in this area has resulted in increased recovery of gold. Yukon Explorations Limited had one dredge in operation during the 1948 season in the Sixtymile area. In the Mayo district, Highet and Haggart Creeks have yielded gold to the value of hundreds of thousands of dollars each, and several other smaller creeks have been worked since 1897. South of Klondike

district, Black Hills, Mariposa, Scroggie, Barker, Kirkman, Canadian, and other creeks continue to be worked intermittently, their total production to date being large. Operations by Yukon Gold Placers Limited on Thistle and Henderson Creeks, with the aid of modern steel dredges, were expected to begin in 1949. Drilling carried out on Clear Creek, which lies between the Klondike and Mayo districts and which was worked on a small scale in the early days, proved the existence of many miles of pay gravel for operation with the aid of modern mechanical equipment. Dredging was commenced in the area in 1943 and has been continued since.

In the last few years exploration of old creeks has proved others besides Clear Creek to be worthy of development with modern methods. The construction of the Haines Cut-off road, which meets the Alaska Highway about 95 miles west of Whitehorse, has provided easier access to placer creeks in southwestern Yukon, and prospecting has been carried on recently on several streams, including Burwash, Bullion, Selwyn and Shorty Creeks. During 1948 Burwash Creek provided the majority of gold produced in Southern Yukon. Using mechanical equipment and sluice-box, prospectors recovered 2,620 ounces of gold from this creek.

Lode Mining

Lode mining in Yukon has not as yet attained the importance of placer mining, and most of the production has come from the Whitehorse and Mayo areas. The Whitehorse copper belt, discovered in 1897, is near the railway and therefore had advantages for early development. The first shipment of ore was made in 1900, and from then until 1912 production was intermittent. Because of the high price of copper, the output was continuous during the next eight years, and in 1916 reached a peak of 2,807,096 pounds of copper, worth $763,586. With the lowering of the price of copper the camp was closed down at the end of 1920, although much material formerly regarded as ore is said to remain. The deposits are of the contact metamorphic type and are exeptionally rich, but spotty and hard to follow.

The Mayo silver-lead veins were found by placer miners in 1906. Mining was commenced in 1913, and, with the exception of 1919 and 1920, some ore has been shipped from the camp each year since. The veins are exceedingly rich in silver, and large tonnages of ore containing 200 to 300 ounces to the ton and many pockets containing 1,000 or more ounces to the ton have been mined.

The Silver King property on Galena Hill was the first mine to enter production, but from 1920 to 1932 most of the silver produced came from mines that were discovered on Keno Hill several miles to the northeast. In 1924 Treadwell-Yukon Corporation Limited built a 150-ton concentrator at Wernecke on the slope of Keno Hill, and this development enabled the mining of lower grade material. Following the decline in the price of silver below 30 cents per ounce, the mill at Wernecke continued to treat the ore in sight until 1932, when it was closed down. Interest then shifted to Galena Hill, where a small tonnage of high grade ore continued to be mined. The Calumet mine deposits were discovered on Galena Hill in 1934, and proved to be the largest and deepest ore-bodies yet found in the district. In 1935 the mill at Wernecke was moved to Elsa on Galena Hill and treated ore from the Silver King, Elsa, and Calumet mines until it was closed down in 1941. A few operators continued to mine and ship small tonnages of high grade ore.

In 1945, Conwest Mining Company, Limited, took an option on properties of Treadwell-Yukon Corporation Limited, in the Mayo District, and later that year the Keno Hill Mining Company, Limited now United Keno Hill Mines Limited, was incorporated to acquire and work available holdings. Work on the property, including the repair of camp buildings and cleaning out of old workings, was undertaken in 1946 and operations commenced in December of that year, mining the Elsa and Calumet-Hector properties of this company.

Some lode gold has been mined in the Klondike and Carmacks districts. In the Klondike several prospects have been worked at the heads of the placer creeks, the most important being the Lone Star mine between Bonanza and Eldorado Creeks. A lode gold discovery was made in the Carmacks district on Freegold Mountain in 1930 and since then many other lode prospects of gold and other metals have been found in that area. Gold has been mined from two properties, the more important of which the Laforma mine, produced approximately 1,150 ounces of gold in 1939. Some silver and copper were also recovered by this company, which later closed down. A new interest in the property developed in 1946, and early in 1947 it was reported that an option to purchase had been signed by Transcontinental Resources, Limited.

In 1945, gold discoveries were made in the vicinity of Victoria and Nansen Creeks, west of Carmacks, and options on several properties were obtained by Yukon Northwest Explorations Limited with a view to their development. By the end of 1946 a sufficiently large body of ore had been blocked out to warrant the formation of a new company known as Brown-McDade Mines Limited. Considerable equipment was moved to the property during the winter of 1946-47, preparatory to erecting a mill in 1947. Prospecting on properties acquired in the vicinity of Nansen Creek was also commenced in 1947 by Conwest Explorations Limited. However, operations by these companies have been discontinued, pending an adjustment in the price of gold.

Construction of the Alaska Highway through southern Yukon opened up a new field for prospecting, and in 1945 drilling was undertaken by the Hudson Bay Exploration and Development Company Ltd., on a group of claims on Log Jam Creek in the Swift River district. Another company engaged in exploratory work on claims in Dublin Gulch in the Mayo district.

Aside from those mentioned, lode discoveries have been made in many parts of Yukon, the most easily accessible being the gold, silver, lead, copper, and antimony occurrences in the Wheaton district. Several large persistent veins containing antimony have been prospected in the district, but no deposit of commercial grade has been found.

A few thousand pounds of tungsten concentrates were shipped in 1918 from the gold placers of Dublin Gulch in the Mayo district and from Canadian Creek in the Klotassin River area. The placers of Dublin Gulch again produced tungsten from 1941 to 1945. Veins and contact metamorphic deposits of tungsten-bearing minerals have been found near Dublin Gulch and near the head of Highet Creek.

Tin in the form of crystalline cassiterite was found in the placer gravels of Dublin Gulch in 1941, and later in many other placer creeks of the Mayo district, including Clear Creek. An estimate based on the meagre figures available suggests the presence of 200 or more tons of tin in these gravels. In 1943 a lode discovery assaying up to 1·53 per cent of tin was discovered on the north side of Dublin Gulch.

Coal Mining

Coal produced in Yukon is used to meet the local needs, which are small and uncertain. It has come from five localities, namely, Rock Creek on the Klondike River, Coal Creek on the Yukon River, Granite Creek on the Duke River, Carmacks, and the Whitehorse-Wheaton area. In the first three areas the coal is Tertiary lignite, and in the other two areas good bituminous coal of late Mesozoic age has been found. Most of the output, however, has come from three mines near Carmacks, where production began in 1900 and continued with short interruptions until 1938, when operations were suspended. It reached a peak of 16,185 tons valued at $110,925 in 1910. Interest in the coal property at Tantalus Butte, about four miles upstream from Carmacks, was revived in 1947, when investigations were undertaken to determine the quality and extent of the deposits.

The Tantalus Butte deposits, now operated by the Yukon Coal Company Limited, mined 1,535 tons in 1948. This production was disposed of in the local markets.

Future Prospects

To date, production of minerals in Yukon has come from a few rich deposits. No area has been thoroughly prospected and little drilling has been done except for placers. Prospecting has been handicapped by the remoteness of the Territory and the length of the winter season, but much of the geology of areas that have so far received little active attention is favourable for the occurrence of minerals. This factor, together with the variety and widespread distribution of the lode and placer prospects, suggests the possibilities for expansion in mineral development.

Mining is, and will continue to be, the main export industry of Yukon Territory. It is an industry closely associated with transportation. Viewing transport possibilities broadly, it will be seen that most of Yukon is located within 500 miles of the ocean port of Skagway. The greater portion of the Territory, therefore, can be made one of the most accessible parts of Canada to world-wide ocean transport.

Summary of Mineral Production

According to figures released by the Dominion Bureau of Statistics at Ottawa, the value of mineral production in Yukon Territory was as follows:

	1945	*1946*	*1947*	*1948*	*Total Production to end 1948.*
Gold (1).....	$1,221,258	$1,664,260	$1,671,075	$2,121,490	$217,605,669
Silver (2).....	11,824	26,124	267,877	1,288,964	22,577,899
Lead.....	5,976	3,520	156,556	829,599	5,375,759
Copper.....	—	—	—	—	2,711,695
Coal.....	—	—	—	25,857	829,049
Tungsten.....	—	—	—	—	18,315
Antimony.....	—	—	—	—	173
TOTALS.....	$1,239,058	$1,693,904	$2,095,508	$4,265,910	$249,118,559

(1) Includes gold from the refining of silver, lead, and copper ores and a small amount from lode gold mining in addition to that from placer mining.

(2) Includes silver from the refining of placer gold as well as that from lode mines.

WATER POWER

NO comprehensive examination of the water power possibilities of Yukon Territory has been undertaken, but reconnaissance investigations carried out some years ago by the Dominion Water and Power Bureau of the Department of Mines and Resources indicated resources of quite substantial magnitude in the Whitehorse and Mayo districts. For the most part the great rivers of the Territory and many of their tributaries are of uniform gradient and are navigable except in their upper reaches. Water power possibilities, therefore, are to be found chiefly on these upper reaches. The climate and topography are such as to cause great variations in the seasonal flow of the rivers, with high flows in the open season and greatly diminished flows during the winter months. Power possibilities, accordingly, are affected in like manner by these seasonal flows.

Development of water power in Yukon Territory has taken place almost wholly in connection with placer gold mining operations. The Yukon Consolidated Gold Corporation owns and operates a hydro-electric plant on the Klondike River about 26 miles above Dawson. A continuous and assured flow of water the year round is obtained for this plant by a diversion from the south fork of the Klondike River into the north fork of the same stream, and by a large ditch from this north fork to the power plant. The ditches freeze over in winter and as the water flows under the ice as in a river, power is generated the year round. This plant was constructed in 1911 with an installation of two 5,000 horse-power units and was enlarged in 1935 by the addition of a similar unit bringing the total capacity to 15,000 horse-power. Power is transmitted principally for the operation of gold dredges, pumps in stripping and thawing operations, and the company's machine shops in the Dawson area. A small amount of power is also sold in bulk to the Dawson Electric Light and Power Company, Limited, for distribution in Dawson.

Of undeveloped water power resources, reconnaissance investigations indicated that at Miles Canyon on the Lewes River, about four miles from Whitehorse, a development should be possible under a head of about 50 feet which should yield about 9,000 dependable horse-power. In the Mayo district investigations disclosed a site at Fraser Falls on the Stewart River, some 40 miles above Mayo, where a head of 80 feet might be secured making 7,000 horse-power available under ordinary minimum flow or 22,000 horse-power ordinarily available for six months of the year. At the canyon on the Mayo River about five miles from Mayo a head of 250 feet might be concentrated that should yield about 2,400 horse-power at ordinary minimum flow, but with storage developed upon Mayo Lake this might be raised to 14,000 horse-power of dependable power. On Janet Creek in the same district a small site offered possibilities of some 240 horse-power at ordinary minimum flow or about 1,400 horse-power if storage should be developed.

In addition to these sites, power possibilities are indicated by explorations of the Geological Survey of Canada on the Peel River, and it is probable that many of the smaller rivers and creeks in the Territory are capable of developing moderate quantities of power, at least during the open season.

THE FUR INDUSTRY

THE fur trade is the oldest industry in Yukon. It had its beginning in 1842 when Robert Campbell of the Hudson's Bay Company established Fort Frances on Frances Lake, which he had discovered and named in 1840. A small trading post was constructed at Pelly Banks on the upper Pelly River in the winter of 1842-43, and in 1846 Fort Pelly Banks was built. In 1848 Campbell opened the post of Fort Selkirk at the junction of the Lewes and Pelly Rivers. This post remained the centre of the fur trade in the upper Yukon region until 1852, when the fort was attacked and sacked by Indians from the Pacific Coast, and abandoned by the Hudson's Bay Company.

Prior to 1851 fur from upper Yukon was transferred to Fort Simpson in the Mackenzie Valley by way of the Pelly, Frances, and Liard Rivers. In that year Campbell pioneered a new route down the Lewes and Yukon Rivers to Fort Yukon, a Hudson's Bay Company post erected in 1847 at the mouth of the Porcupine River. From Fort Yukon the fur was transported up the Porcupine River and over the height of land to the Mackenzie Valley. In 1869, when Fort Yukon was found to be in United States territory (Alaska), the post was moved up the Porcupine into Canadian territory; it was, however, abandoned a short time later. This action marked the retirement of the Hudson's Bay Company from trade in the Yukon River Basin for more than half a century. In recent years, however, the company has reopened several trading posts, including those at Fort Selkirk, Stewart River, and Frances Lake.

Following the sale of Alaska to the United States in 1867, American trading companies extended their field of operations into Canadian territory and for many years operated posts at points along the Yukon River. The Northern Commercial Company and Taylor and Drury Limited have maintained trading posts in the Territory for many years, and, together with the Hudson's Bay Company, now share much of the fur trade. In addition, many individual traders operate under licence.

Hunting and Trapping

The holder of a Resident Hunting Licence may take big game and game birds protected by the Game Ordinance during the period of open season. Holders of Resident or Non-resident Trapping Licences may take fur-bearing animals and such big game and game birds as they require for their own use. No person whose main occupation is other than trapping may be granted a trapping licence unless he had established an interest in a trap line prior to 1947 and is partly dependent on the income therefrom.

A Canadian citizen qualifies as a resident if immediately prior to date of application for a licence he has resided continuously in the Territory for one year, or for 30 days if a member of His Majesty's Armed Forces or the Royal Canadian Mounted Police. An alien may be granted a Resident Hunting Licence after two years continuous residence. He may not be granted a trapping licence unless prior to 1947 he was resident in the Territory, held an Alien Resident Trapping Licence, and had established an interest in a trap line, and unless he has applied for Canadian citizenship.

Note: Hunting and trapping licence fees will be found on page 54 of this booklet.

Fur Production

Although several fur farms are operated in the Territory, principally in southern Yukon, most of the fur produced is harvested from wildlife. The fur industry provides a livelihood for a large proportion of the Indian population. The following statement, covering the fiscal years 1947-48 and 1948-49, shows the principal species of furbearing animals in the Yukon Territory and the numbers taken in those years:

Kind of Fur	*Number of Pelts Taken*	
	Year ended March 31, 1948	*Year ended March 31, 1949*
Bear, White or Polar	...	1
Bear, not specified	31	28
Beaver	3	...
Coyote	14	46
Fisher	35	39
Fox — Black	1	1
Fox — Blue	...	...
Fox — Cross	338	322
Fox — Red	705	520
Fox — Silver	80	47
Fox — White	14	2
Lynx	1,888	1,366
Marten	2,902	1,767
Mink	2,321	1,172
Muskrat	43,712	32,158
Otter	58	25
Squirrel	64,834	138,468
Weasel	2,960	1,440
Wolverine	207	211
Wolf	18	9
Total	120,121	177,622

Game Preserves and Sanctuaries

Hunting and trapping in the Territory are controlled by provisions of the Yukon Game Ordinance. A native game preserve, known as the "Peel River Game Preserve" and containing an area of 4,000 square miles, has been established to assist in maintaining the basic industry of the native population. In this area hunting and trapping are confined to natives and half-breeds living the life of natives. Hunting and trapping are not permitted in the Kluane and McArthur Game Sanctuaries, nor within an area extending for a distance of one mile on either side of the Alaska Highway and the Haines Cut-off road. In other parts of Yukon Territory natives may hunt and trap under free permit.

Elsewhere in this publication will be found a summary of the Game Regulations for the Yukon Territory.

AGRICULTURE

AGRICULTURE has been carried on in Yukon Territory since the beginning of the present century, when farming and gardening were instituted to augment the food supply for the influx of population that followed the Klondike "strike". Early settlers found that the far northern latitude did not hinder the successful growing of field crops and vegetables during the long days of a short summer season, and, owing to the high prices prevailing for food, general farming proved economically possible. During the period of greatest mining activity farms totalling several thousand acres were cleared in west central Yukon, and a variety of produce was grown.

Following the peak years of the mining boom the population of the Territory declined, and this factor, coupled with an increasing use of mechanical equipment instead of horses, resulted in a loss of local markets for grain and fodder. Consequently many farms were abandoned. The decline in general agriculture, however, was accompanied by an increase in gardening, and horticulture is now almost a self-sustaining home industry.

Current agriculture operations are not extensive. In 1941 a total area of 2,781 acres was contained in the 26 farms operated. Of these farms only two exceeded 300 acres in extent, and the balance were less than 200 acres each. The total area under crops, however, was 511 acres only. All farms were worked by owners, and were devoted to a variety of purposes, including the production of field crops, tubers, vegetables, and live stock. Most of the general-purpose farms are sown predominantly in brome grass for hay, and yields vary from one to two tons per acre. In addition smaller areas are devoted to wheat, oats, barley, alfalfa, and potatoes. Grain crops are usually grown for green feed, although they will ripen in all but unusual years of early frost. Wheat has been matured and harvested in 87 days in the vicinity of Dawson.

Farm income is derived chiefly from the local sale of milk, butter, beef, and pork, and some farmers also sell vegetables. In 1941 two farms were classified as live stock producers. Others maintain some live stock, including horses, cattle, and swine. Some poultry is also raised.

Gardening is a flourishing activity in Yukon, and is possible wherever soils are good. In the principal settlements home gardens supply most of the vegetable requirements of the population. Remarkable results have been achieved in the growing of potatoes, particularly near Dawson and Mayo. Other common varieties grown successfully include carrots, beets, turnips, parsnips, cauliflower, cabbage, and celery. Garden beans and peas bear well in favourable seasons, and rhubarb, radishes, lettuce, Swiss chard, and small onions also thrive. In addition, numerous small greenhouses in Whitehorse, Mayo, and Dawson are used to produce tomatoes and cucumbers. Small fruits, including strawberries, raspberries, currants, and gooseberries, furnish good yields in many localities.

Experimental Work

Experimental work in the form of co-operative trials has been conducted in Yukon by the Dominion Department of Agriculture since 1915. An experimental substation opened in 1917 at Swede Creek, on the left bank of the Yukon River about six miles west of Dawson, was operated until 1925. As a result many interesting facts concerning agricultural possibilities in the region were established. Good crops of wheat, oats, and

barley matured in most years, although occasional early frosts necessitated the harvesting of these crops as fodder. Of the forage crops grown timothy and alfalfa were moderately successful, although the latter did not produce seed. Brome grass proved to be the most successful, and is now the principal hay crop in Yukon.

In 1943 a program of investigation undertaken by the Dominion Government to determine more accurately the possibilities of development of natural resources in northwestern Canada was extended to Yukon Territory. In that year, a broad soil reconnaissance survey of lands adjoining the Alaska Highway, together with those in the Yukon River Basin, was made by a senior soils scientist of the Experimental Farms Service. The following year a site for an experimental substation was selected adjacent to the Alaska Highway, at Pine Creek, about 106 miles west of Whitehorse.

The new substation is situated in the Takhini-Dezadeash Valley, which contains a large area of potential agricultural land. Experiments are being conducted on varieties and methods of production of horticultural and field crops. Poultry and cattle have been established with encouraging success. Hogs will be introduced as cultivated areas for production of grain feed are developed. Although results obtained up to 1948 are encouraging it will be necessary to obtain data from the results of several years' work before definite statements on the agricultural possibilities of this area can be safely made. The resident manager of the substation also undertakes periodic visits to the various settlements along the Yukon River system during the growing season, and furnishes advice to gardeners concerning the choice of suitable varieties and the culture of vegetables and small fruits.

The sub-station staff conducts off-station co-operative field experiments at locational sites in the interior. Test plots of grains, grasses, and legumes have been established on properties at Mayo, Dawson, Ft. Selkirk, Carcross, and are to be undertaken in 1949 in the Takhini valley adjacent to Whitehorse. Thus a complete coverage of the territory will be secured. Spring grains on the sub-station have thus far given gratifying results, barley particularly; a sample of the latter, submitted for official appraisal, was graded the best sample from Western Canada during that season. Oats have responded well also, and wheat, though frequently frost-blemished, has nonetheless produced well. Winter grains, wheat and rye, thus far have been disappointing. Of three seasonal sowings the result has been two complete failures and one outstanding success. In the latter instance both wheat and rye produced good yields and excellent samples. Generally speaking, forage crops have responded well on the station. The gardens of the territory have long been noted for their outstanding yields and the succulence of their produce.

Recent surveys have disclosed that the best soils in the Territory are found in the west central region, where the climate is also most equable. Soils in southern Yukon in the vicinity of Whitehorse are inclined to be arid. Final estimates of the amount of land suitable for future agricultural development will not be possible without further investigation, but reconnaissance up to 1945 indicated that about 160,000 acres could be put under cultivation. Of this area 100,000 acres are located in the Takhini-Dezadeash Valley served by the Alaska Highway, and 60,000 acres along the Yukon River flats. On the other hand no summary of potential agricultural land should disregard the Nordenskiold and Stewart Valleys. Homesteads have been taken up on lake-bottom land in the former valley,

near Carmacks, and on the Stewart from Mayo Landing downstream to its confluence with the Yukon River, at the post of Stewart, extensive bench areas invite investigations. On some of these bench areas former cultivation proved gratifyingly successful. Displacement of horses by automotive power at the mines forced abandonment of many of these agricultural ventures.

Although general farming is limited to those valleys in which soil suitable for cropping purposes occurs, a much larger area, particularly in southern Yukon, could be used for grazing purposes. Native horses rustle out all winter in the southwestern valleys, and in the spring months the females frequently come in from the native meadows with colts at heel. These mares and colts invariably appear in excellent condition. However, both general farming and ranching are handicapped by lack of markets, as the sale of farm produce is limited to local residents.

The future of agriculture in the Territory is closely linked with the development of other resources, and probably will always be dependent on mining — the chief industry — for the profitable disposal of farm produce. Agricultural settlers are not being encouraged, however, until more is known about the climate, soils, and other characteristics of the regions.

GENERAL INFORMATION

Opportunities for Employment

OPPORTUNITIES for employment in Yukon Territory are provided principally by the mining industry, and to a lesser degree by companies and services which supply public transportation. National Employment Service offices have been established by the Department of Labour at Whitehorse and Dawson, and inquiries should be directed to the managers of these offices, which are actively in touch with those who are in a position to offer employment. Inquiries concerning prospective employment also may be directed to the Commissioner, Yukon Territory, at Dawson.

Business Opportunities

Persons desiring to operate tourist camps, gasoline stations, or other concessions along the Alaska Highway or elsewhere in Yukon Territory are reminded that the tourist business, particularly in this part of Canada, is a seasonal occupation. It is, therefore, apparent that any venture of this nature should be augmented by some other enterprise to be self-sustaining throughout the year. Additional information concerning business opportunities or business licences in Yukon Territory should be obtained from the Commissioner, Yukon Territory, at Dawson, or from the Territorial Agent at Whitehorse.

Cost of Living

Owing to the long distances over which commodities must be imported, and the high cost of transportation, the cost of living in Yukon Territory is considerably greater than in the provinces. As a general rule the cost of clothing, food, and other necessaries is at least 25 per cent more than in the more southerly parts of Canada.

Immigration Requirements

Citizens of the United States or other countries desiring to settle on lands or engage in other occupations in Yukon Territory should apply to the Director of Immigration, Department of Citizenship and Immigration, Ottawa, Canada, for information concerning immigration requirements.

MAPS

Topographical maps of Yukon Territory on various scales may be obtained at a nominal charge from the Legal Surveys of the Surveys and Mapping Bureau, Department of Mines and Technical Surveys, Ottawa, Canada. Geological maps of mineral areas may be obtained from the Geological Survey of Canada, Department of Mines and Technical Surveys, at Ottawa. These services supply map index sheets free of charge. A limited number of maps are also available from the Commissioner of Yukon Territory at Dawson.

General

Requests for general information concerning all matters relating to Yukon Territory should be addressed to the Commissioner, Yukon Territory, at Dawson, or to Northern Administrations, Department of Resources and Development, Ottawa.

APPENDICES

DIRECTORY OF OFFICIALS IN THE YUKON TERRITORY

Dominion Officials

Department of Resources and Development

Commissioner, Yukon Territory ..... J. E. Gibben, K.C., Dawson
Registrar of Land Titles ..... J. E. Gibben, K.C., Dawson
Deputy Registrar of Land Titles ..... Miss R. R. MacDonald, Dawson
Mining Recorders : Dawson District ..... J. D. Dines, Dawson
Mayo District ..... G. McIntyre, Mayo
Whitehorse District ... W. M. Emery, Whitehorse
Forest Protection ..... F. H. R. Jackson, Whitehorse

Justice Department

Stipendiary Magistrate ..... L. H. Phinney, Dawson
Registrar and Reporter ..... A. C. Barnes, Dawson
Sheriff ..... A. C. Barnes, Dawson
Public Administrator ..... G. C. Van Roggen, Whitehorse.

Department of Labour

Manager, National Employment Service ... J. H. Fox, Whitehorse
Representative, National Employment Service ..... H. W. Firth, Dawson

Department of National Defence

Officers in charge, R.C.C.S. Radio Stations:
Whitehorse ..... W. O. 1. N.J. MacLeod
Dawson ..... W. O. 1. D. Patrick
Mayo ..... Sgt. Maj. R. L. Kerr

Department of National Revenue

Collector of Customs and Excise:—
Dawson ..... J. O. Williams
Whitehorse ..... G. S. F. Watson
Inspector of Income Tax (Yukon District) .. C. Grant, Dawson

Department of Public Works

Agent, Dominion Public Buildings ..... J. E. Gibben, K.C., Dawson

Royal Canadian Mounted Police

Whitehorse Sub-Division ..... Sub. Insp. H. J. Spanton
Dawson Detachment ..... Cpl. P. W. Clearwater

Department of Transport

Assistant District Airways Engineer ..... L. Keith, Whitehorse
District Manager, Dom. Govt. Telegraph Service ..... J. B. Watson, Whitehorse

Territorial Officials

Territorial Secretary and Treasurer ..... W. A. Wardrop, Dawson.
Superintendent of Works and Buildings .... B. Harvey, Dawson.
Superintendent of Schools ..... Ronald Hulland, Dawson.
Legal Adviser ..... Miss R. R. MacDonald, Dawson
Supt. of Game and Publicity ..... Them Kjar, Dawson.
Supt. Liquor Control ..... L. Higgins, Whitehorse
Territorial Assayer ..... W. C. Sime, Keno
Territorial Agent ..... G. Bidlake, Whitehorse.
Territorial Agent ..... A. Smith, Mayo.

SUMMARY OF REGULATIONS GOVERNING THE DISPOSAL OF LANDS, TIMBER, GRAZING, AND HAY

CROWN land in the Yukon Territory may be disposed of by sale, lease or permission to occupy, in accordance with the terms of the Yukon Land Regulations. The maximum area which may be purchased by an individual in any one locality is 160 acres. Sales are restricted to lands which are surveyed. Unsurveyed lands may be staked and an application may be filed.

Applications for land privileges should be made to the Commissioner of Yukon Territory, Dawson, or to the Agents of Dominion Lands at Whitehorse or Mayo, Yukon Territory, from whom application forms and additional information may be obtained. Applications for land purchases, leases or "Permissions to Occupy" must be accompanied by an application fee of $5.

Timber

Under the Timber Regulations, permits free of dues may be granted to any educational, religious, or charitable institution to cut timber for its own use, but fixed dues are charged on timber cut for any other purposes. Application for timber privileges should be made to the Crown Timber Agent for the district concerned.

Grazing and Hay

Grazing leases and permits to cut hay on vacant Crown land may be obtained from the Agent of Dominion Lands in accordance with the provisions of the Hay and Grazing Regulations.

SYNOPSIS OF MINING ACTS AND REGULATIONS

UNDER the Yukon Placer and Yukon Quartz Mining Acts any person eighteen years of age and over has the right, with certain reservations, to enter, locate, prospect, and mine upon any lands in Yukon Territory whereon the right to mine minerals has not been alienated from the Crown. These Acts, with subsequent amendments, as passed by the Parliament of Canada, govern placer and quartz mining in the Territory.

No person shall enter for mining purposes or shall mine upon lands owned or lawfully occupied by another until adequate security has been furnished to the satisfaction of the Mining Recorder for any loss or damage which may be thereby caused.

Where claims are being located which are situated more than one hundred miles from the Mining Recorder's Office, the locators, not less than five in number, are authorized to meet and appoint one of their number an emergency recorder, who shall as soon as possible deliver the applications and fees received to the Mining Recorder for the district.

If two or more persons own a claim each such person shall contribute, proportionately to his interest, to the work required to be done thereon, and in the event of it being proved to the Commissioner that he has not done so his interest may be vested in the other co-owners.

The survey of a claim made by a duly qualified Dominion Land Surveyor shall be accepted as defining absolutely the boundaries of the claim surveyed, provided the survey is approved by the proper authority and remains unprotested during the period of advertisement.

A person about to undertake a bona fide prospecting trip may, on payment of a fee of two dollars ($2.00), secure from the Mining Recorder written permission to record within six months at his own risk a claim under the Placer Mining Act.

A legal post must stand four feet above the ground, squared or faced for the upper eighteen inches and measuring four inches across the faced portion. The post must be firmly fixed in the ground.

Placer Mining

Creek means any natural watercourse, whether containing water or not, having an average width of less than one hundred and fifty feet.

Creek claims shall not exceed five hundred feet in length, measured along the base line or general directions of the creek, by one thousand feet on each side of the base line. Other claims shall not exceed five hundred feet in length by one thousand feet in depth. Claims shall be as nearly as possible rectangular in form and shall be marked by two legal posts, one at each end of the claim, numbered "1" and "2" respectively. Location posts shall be placed on the base line of creek claims and parallel to the base line of all other claims, and on the side of the claim nearest the creek or river toward which it fronts.

Any person locating the first claim on any creek, hill, bench, bar, or plain upon which there is no recorded claim shall be entitled to one claim 1,500 feet in length; two locators shall each be entitled to one claim of 1,250 feet in length; each member of a party exceeding two persons may stake a claim of ordinary size only.

The boundaries of any claim may be enlarged to the size of a claim allowed by the Act, if the enlargement does not interfere with the rights of other persons or the terms of any agreement with the Crown.

An application for a claim must be filed with the Mining Recorder within ten days after being located if within ten miles of the Recorder's Office. One extra day shall be allowed for every additional ten miles or fraction thereof. A claim may be located on Sunday or any public holiday.

Any person having recorded a claim shall not have the right to locate another claim in the valley or basin of the same creek within sixty days of locating the first claim.

Title.—Any person, having complied with the provisions of the Act with respect to locating and recording a claim, shall be entitled to a grant for one year and shall have the absolute right of renewal from year to year thereafter, provided during each year he does or causes to be done $200 worth of work on the claim, files with the Mining Recorder within fourteen days after the expiration of the claim an affidavit showing a detailed statement of the work, and pays the required renewal fee.

Grouping.—Under certain conditions claims may be grouped and the work required to be performed to entitle the owner or owners to renewals of the several claims grouped may be performed on any one or more of the claims in the grouping. Grants of claims grouped or owned by one person may be made renewable on the same date.

Taxes and Fees.—A royalty is collected on all gold shipped from Yukon Territory.

Fees

1. For grant of a claim for one year	$10.00
2. For a grant of a claim for five years	50.00
3. For renewal of grant of a claim:	
For one year	10.00
For two years	20.00
For three years	30.00
For four years	40.00
For five years	50.00
4. Recording an abandonment	2.00
5. For a grouping certificate:	
(a) Ten claims or under	5.00
(b) Over ten claims	5.00
For each claim over ten	1.00
6. Registration of any document	2.00
If it affects more than one claim, for each additional claim	1.00
7. For filing any document	1.00
8. Abstract of title:	
For first entry	1.00
For each additional entry	.10
9. For copies of any documents recorded:	
Up to three folios	3.00
For each additional folio	.50
10. For grant of water:	
Of 50 inches or less	10.00
From 50 to 200 inches	25.00
From 200 to 1,000 inches	50.00
For each additional 1,000 inches or fraction thereof	50.00

Subject to the boundaries of other claims in good standing at the time of its location, a mining claim shall be rectangular in shape and shall not exceed 1,500 feet in length by 1,500 feet in width.

Every claim shall be marked on the ground by two legal posts, one at each extremity of the location line, numbered "1" and "2" respectively. On the side of No. 1 post facing No. 2 post shall be inscribed the name of the claim, a letter indicating the direction to No. 2 post, the number of feet to the right or left of the location line, the date of location, and the name of the locator. On No. 2 post on the side facing No. 1 post shall be inscribed the name of the claim, the date of location, and the name of the locator.

The claim shall be recorded within fifteen days if located within ten miles of a Mining Recorder's Office; one extra day shall be allowed for every additional ten miles or fraction thereof.

Adjoining claims not exceeding sixteen in number may be grouped. The necessary representation work for each claim may then be performed on any one or more of the claims in the group.

Every application for a full claim shall be made on Form "A".

Form "A-1" should be used for a fractional claim.

No person shall be entitled to locate, whether personally, as attorney for another, or by an attorney, more than seven mineral claims in the aggregate within a distance of ten miles from any other mineral claim (making a total of eight mineral claims) located by him personally, as attorney, or by attorney, during a period of twelve months.

The timber on a mineral claim is reserved until the Mining Recorder certifies that it is not required for use in mining operations on the claim. The Commissioner, however, may issue a permit to holders of other claims to remove the timber for use in their mining operations where other timber is not readily available.

Title.—Any person having complied with the provisions of the Regulations with regard to locating and recording a claim shall be entitled to hold it for one year from the date of the record and thereafter from year to year, provided during each year he does or causes to be done work on the claim to the value of $100, and shall, within fourteen days after the expiration of the year, satisfy the Mining Recorder that the work has been done and pay the certificate of work fee. One hundred dollars may be paid each year in lieu of assessment work other than survey. Any person having completed representation work for five consecutive years, including a survey of the mineral claim or having made payment in lieu thereof as provided under the Act, may apply for and obtain a lease.

Royalty.—There shall be paid to the Crown on every mine in the Yukon Territory, acquired under the provisions of this Act or under the provisions of the Quartz Mining Regulations preceding the said Act, an annual royalty on any profits of such mine which exceed the sum of $10,000 during any calendar year, and the owner, manager, holder, tenant, lessee, occupier or operator of the mine shall be liable for and shall pay to the Crown an annual royalty as follows:—

(a) Upon annual profits in excess of $10,000. and up to $1,000,000 ..... 3 per centum;

(b) On the excess above $1,000,000. up to $5,000,000 ..... 5 per centum;

(c) On the excess above $5,000,000. up to $10,000,000 ..... 6 per centum;

(d) On the excess above $10,000,000. a proportional increase of one per centum for each additional $5,000,000.

Fees

1.	Recording mineral claim	$10.00
2.	For a substitutional record	10.00
3.	Application for a lease and issue of same	10.00
4.	Recording every certificate of work	5.00
5.	For a certificate of improvements	5.00
6.	For a grouping certificate (1946, c. 13, s. 7)	5.00
7.	Recording assignments, abandonments, affidavits, or any other document	2.50
	If document affects more than one claim, for each additional claim	1.00
8.	For granting period of six months within which to record	4.00
9.	For an abstract of the record of a claim:	
	For the first entry	4.00
	For each additional entry	.50
10.	For copies of any documents recorded where same do not exceed three folios	4.00
	Where such copies exceed three folios, 30 cents per folio for every folio over three	
11.	For recording a power of attorney to stake from one person	4.00
12.	For recording a power of attorney to stake from two persons	8.00
13.	For recording an assignment of a quartz mining lease	3.00
14.	Rental, whole or fractional mineral claim granted under lease for term of 21 years	50.00
15.	Rental for renewal term of 21 years	200.00
16.	Rental iron and mica claim as defined by Section 18	150.00
17.	Rental for renewal term of 21 years iron and mica claim	600.00

When powers of attorney to stake and permission to record within six months relate to placer mining claims also, the fees prescribed by the Placer Mining Act and Regulations shall be collected in addition to the fee prescribed by these regulations.

Miscellaneous

Dredging.—A lease may be issued for a period of fifteen years for a continuous stretch of river not exceeding ten miles in length giving the exclusive right to dredge for gold, silver, and platinum. The lessee must have at least one dredge in operation on the leasehold within three years. "River" means a stream of water, the bed of which has an average width of 150 feet throughout the portion to be leased.

Petroleum and Natural Gas.—A lease may be issued for a period of twenty-one years for an area not less than 1,280 acres and not exceeding 2,560 acres giving the right to the petroleum and natural gas on the area leased. A rental is charged of 50 cents per acre for the first year and $1 per acre for each subsequent year.

Coal.—A lease may be issued for a period of twenty-one years for an area not to exceed 2,560 acres; the length of the location must not exceed four times its breadth. The lease conveys the coal mining rights only, but surface rights may be obtained by arbitration if already disposed of, or under lease from the Crown if vacant. Rental is payable on coal leases at the rate of one dollar per acre per year.

Copies of the Yukon Mining Acts and Regulations may be obtained from the Commissioner, Yukon Territory, at Dawson, from any Mining Recorder in Yukon Territory, or from the Chief, Lands Division, Development Services Branch, Department of Resources and Development, Ottawa, Canada.

SUMMARY OF THE GAME REGULATIONS

HUNTING and trapping in Yukon Territory is controlled by provisions of the Yukon Game Ordinance. No person shall engage in hunting or trapping game without being the holder of a valid and subsisting licence or permit issued pursuant to this Ordinance. Any person whose main occupation is other than trapping shall not be deemed eligible for a trapping licence.

For the purpose of the Yukon Game Ordinance, "resident" means any Canadian citizen who has resided continuously in Yukon Territory for not less than one year immediately prior to the date of his application for a licence.

Regulations have been enacted from time to time to establish special sanctuaries or preserves for the protection of game and fur, and to restrict

hunting and trapping in areas where species are believed to be in danger of decimation. Included among such areas are the following:

Kluane Game Sanctuary—An area of approximately 10,000 square miles in southwestern Yukon, in the vicinity of Kluane Lake. In this area the hunting, trapping, or molesting of game and birds is prohibited. Most of the lands within this game sanctuary have also been reserved from disposal so that they may be available in their present state for establishment as a national park.

Peel River Native Game Preserve—An area of approximately 4,000 square miles in northeastern Yukon, established in 1923 for the benefit of the native Indian, Eskimo, and half-breed population, which has exclusive hunting privileges therein. This preserve adjoins a similar game preserve of 3,300 square miles in the Northwest Territories which bears the same name.

Alaska Highway—The Game Ordinance of Yukon Territory provides that no person shall hunt, trap, kill, shoot at, wound, injure, or molest in any manner, any wildlife, including bear, within an area extending for a distance of one mile on either side of the centre line of the Alaska Highway and Haines Cut-off road.

McArthur Game Sanctuary—An area of approximately 204 square miles in the McArthur Range. Scenic mountain area containing the rare Fannin sheep; also big caribou, and grizzly bears. Accessible to a main road which will eventually connect Whitehorse with Dawson and Mayo. The Sanctuary also contains hot springs.

Hunting and Trapping Licences

Hunting and trapping licences are available on payment of the following fees:

RESIDENT:	
Hunting licence	$ 1.00
Trapping licence	2.00
NON-RESIDENT:	
Big game hunting:	
Canadian citizen	75.00
Alien	100.00
Trapping licence:	
Canadian citizen	250.00
Game bird licence	5.00
Special Bear Hunting Licence:	
For a Canadian citizen	25.00
For an alien	50.00
INDIAN:	
Combined Indian hunting and trapping licence — free.	

Open Seasons and Bag Limits

Moose, mountain sheep, mountain goat.—Open season, August 1 to November 30. Bag limit — one moose, one mountain sheep, one mountain goat.

Caribou.—Open season, August 1 to January 31. Bag limit (resident) —one woodland caribou and four migratory caribou; (non-resident) — one caribou of each species.

No female, and no animal of the above species under the age of one year, shall be killed at any time.

Bear.—No close season; no bag limit.

Beaver.—Limited trapping under special permit.

Buffalo, bison, elk (wapiti) or any species of deer.—No open season at any time.

Game Birds.—Ptarmigan, sharp-tailed grouse, Franklin grouse, spruce grouse (fool hen). — Open season, September 1 to January 31. *Ruffed (willow) grouse* and *blue grouse.* — Open season, September 1 to October 31. Bag limits — Not more than 15 birds daily in the aggregate or 30 during the season.

Waterfowl. Ducks, geese, and *Wilson's snipe* or *jacksnipe* (except species not permitted to be taken under the Migratory Birds Convention Act and Regulations). — Open seasons and bag limits as permitted under the Migratory Birds Convention Act and Regulations.

Full information concerning the Game Regulations is contained in the Game Ordinance and Fur Export Tax Ordinance, copies of which may be obtained from the Commissioner, Yukon Territory, at Dawson, or from Northern Administrations, Department of Resources and Development, Ottawa, Canada.

SUMMARY OF SPORT FISHING REGULATIONS

A permit is necessary to angle in Yukon Territory. The annual fees for such permit are:

Residents	$ 1.00
Non-residents	$ 2.00

Open Seasons

Whitefish, lake trout, salmon trout—December 1 to September 14.

Speckled trout (including *char*)—March 31 to October 31.

Maskinonge, pike, pickerel, gold-eye, mullet—May 16 to April 14.

Grayling—February 1 to November 30.

Tullibee (Cisco)—December 16 to October 14.

Fishing through the ice for speckled trout of any kind, including char, is prohibited.

The use of spears, lights, firearms, dynamite, or other explosive material in killing fish is prohibited.

The use of bare unbaited hooks or grapnels is prohibited.

Provision is made in the fishing regulations whereby explorers, prospectors, surveyors, or travellers, while engaged in exploration, mining or survey operations, or other examination of Yukon Territory, may fish at any time without a licence, but with legal implements, for their own domestic use, but not for sale or barter.

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Printed in Canada



The Alaska Highway, ten miles north of Haines Junction.

Airport at Whitehorse.





Above—*Trading Post at Bear Creek, on the Alaska Highway.*

Below—*Territorial Administration Building at Dawson.*





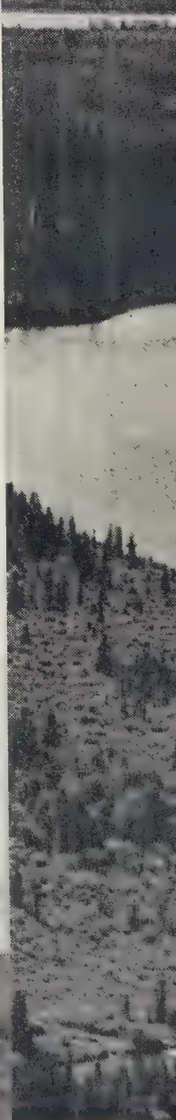
of Whitehorse, looking east.

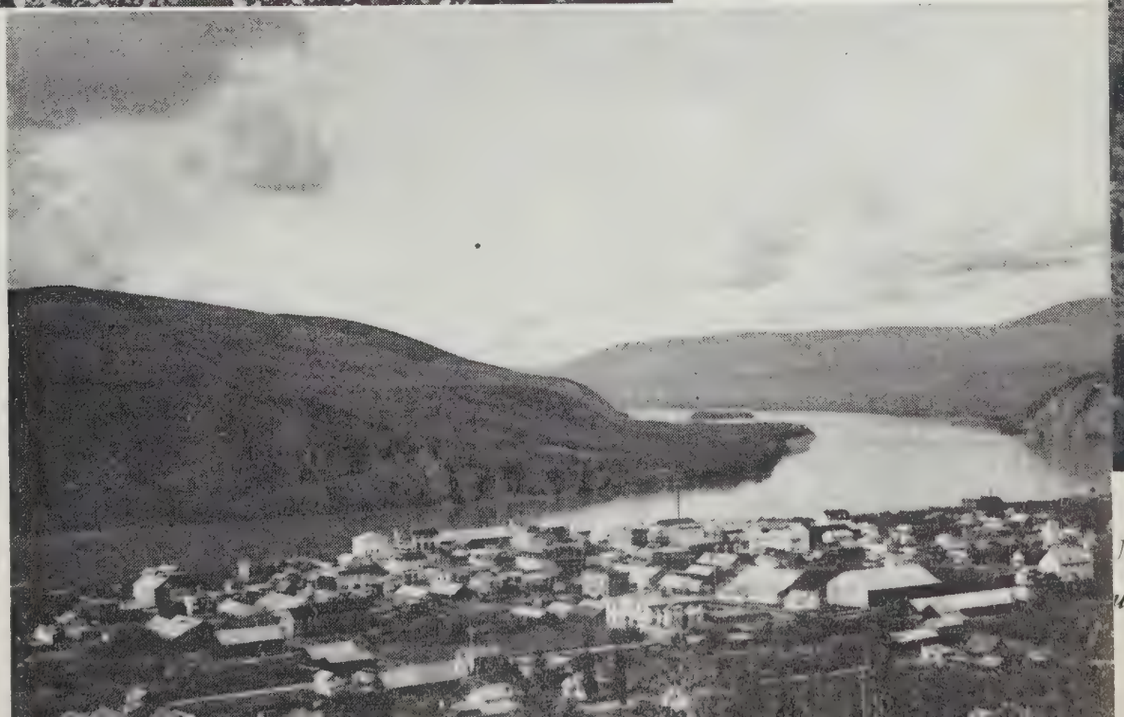
C.P.R. Photo



Historic Miles Canyon on Yukon River near Whitehorse.







son, the Territorial tal. Yukon River in ground.

URNAL, ust, 1945

YUKON TERRITORY

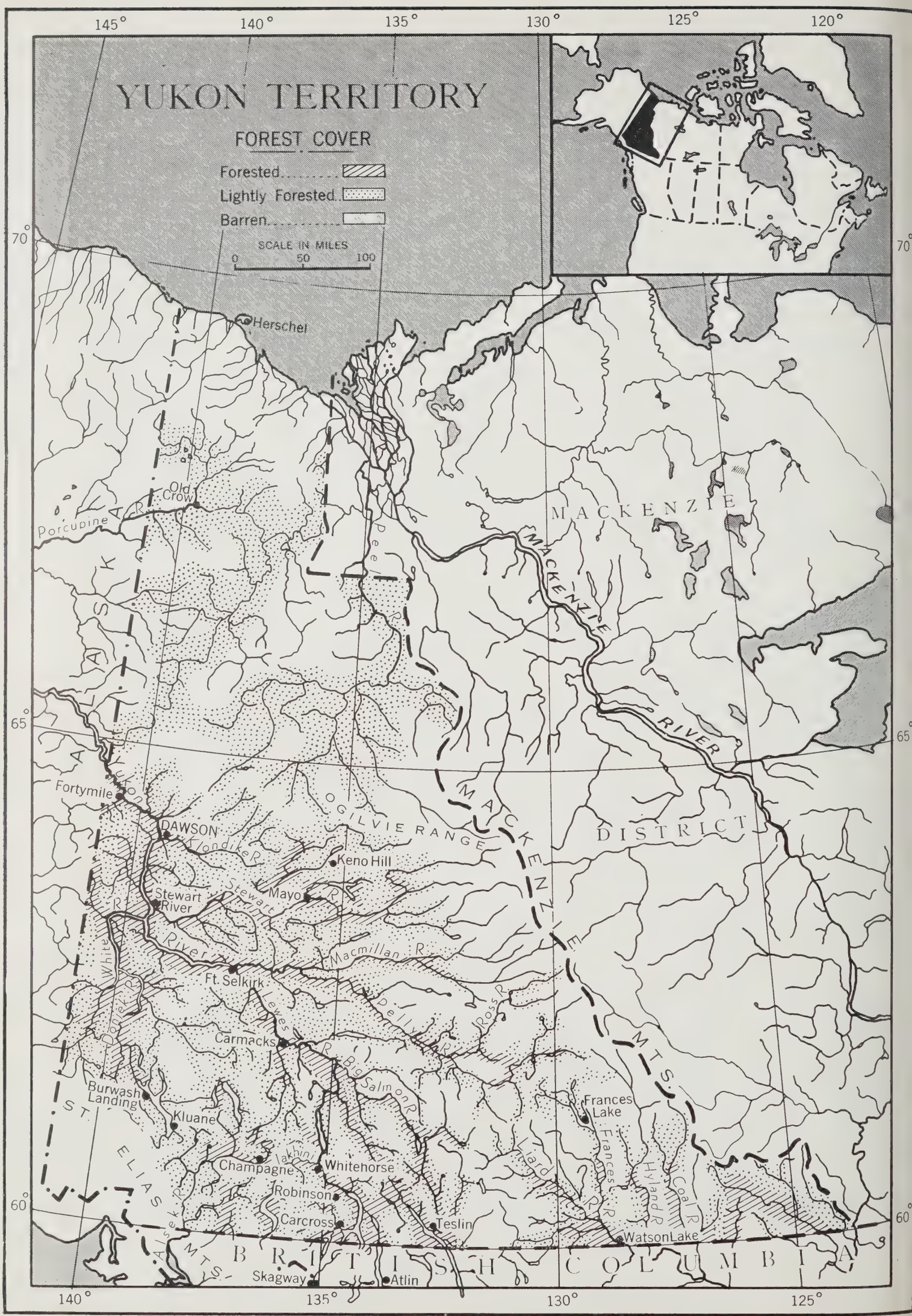


HISTORY, ADMINISTRATION, RESOURCES, AND DEVELOPMENT

Agriculture and Forests of Yukon Territory



Reprinted from the CANADIAN GEOGRAPHICAL JOURNAL,
August, 1945


YUKON TERRITORY
FOREST COVER
Forested
Lightly Forested
Barren
SCALE IN MILES
0 50 100
145°
140°
135°
130°
125°
120°
70°
65°
60°
Herschel
Old Crow
Porcupine R.
Peel R.
MACKENZIE
MACKENZIE RIVER
DISTRICT
ALASKA
YUKON
Fortymile
DAWSON
Klondike R.
OGILVIE RANGE
Keno Hill
Stewart River
Mayo
Stewart R.
White R.
Macmillan R.
Ft. Selkirk
Pelly R.
Ross R.
Lewes R.
Carmacks
Big Salmon R.
MTS.
Burwash Landing
Kluane
Frances Lake
Frances R.
Hyland R.
Coal R.
Liard R.
Champagne
Takhini
Whitehorse
Robinson
Carcross
Teslin
Watson Lake
ST. ELIAS MTS.
Alsek R.
BRITISH COLUMBIA
Skagway
Atlin

Agriculture and Forests of Yukon Territory*

by J. LEWIS ROBINSON

THE ROMANCE and colour of the Yukon have often given Canadians certain misconceptions concerning the Northland. Growing interest in Northern Canada necessitates information about the location and extent of resources which will help to picture conditions there. Mineral resources will undoubtedly be the principal attraction for prospective residents, but behind this industry, and helping to maintain it, will be the resources of the soil. What the area can grow will be an important factor influencing the future settlement.

Certain geographic factors control the limits of agricultural development and forest growth. An assessment of these factors in Yukon Territory forms a background for discussions of future possibilities. It is doubtful if the Yukon could ever develop full-scale agriculture to a degree that it would compete successfully with imported products from more favourably located farming areas. It is also unlikely that the forest resources will ever support a forest industry similar to that of the provinces. Both are necessary and important, however, as local industries to complement the other activities of the region.

Agriculture in the Yukon developed at the beginning of the present century to supply food to the sudden influx of a mining population seeking wealth in "the land of the Klondike". Despite climatic hazards, general farming proved possible in certain favourable locations owing to the high prices paid for food. The early settlers found that the far northern latitude did not prevent the growing of field crops and vegetables during the long days of a short summer season. During the gold rush period farms were cleared in west central Yukon, totalling several thousand acres, to supplement the large amount of imported food.

Yukon miners also found the hillsides and valley bottoms well covered by forests and utilized this resource to assist their mining developments. The forests were cut to become lumber for buildings and timber for mines; thousands of cords were used as fuelwood for the river steamers or were burned to thaw the permanently frozen ground for surface digging, before the present cold water thawing method was developed. Most of the timber resources of the local Dawson-Klondike area were exhausted during the early mining days, but the total forest reserves of the Yukon were more than adequate for the small population and remain to-day for future utilization.

After the peak of the mining boom, population in the Yukon gradually declined. Decreasing population was paralleled by an increased use of trucks and tractors replacing horses, and the market for locally grown grain and fodder became small. The abandonment of farms was accompanied, however, by an increased amount of gardening on the part of the local residents to supply part of their needs for fresh vegetables. At present, horticulture is almost a self-sustaining home industry. One of the factors which has discouraged agricultural development is the availability of country produce in the Yukon. While wild game can be shot, there is no incentive to raise cattle, and similarly wild fruits and berries are too plentiful to encourage their cultivation. These practices are possible when the population is small, but general farming will be needed to supply any increased population.

Physiography

The physical features of the Yukon are

*—Prepared at the Bureau of Northwest Territories and Yukon Affairs, Lands, Parks and Forests Branch, Department of Mines and Resources, Ottawa.



Looking southward over the Glenlyon Mountains and Pelly River, central Yukon.



The mountains of southea

controlling factors in limiting the areas which may have agricultural possibilities or support forest growth. The Territory is a region of hills and mountains separated by a network of large valleys. The main feature is the basin-like area called the Yukon Plateau, which has an average elevation of 2,000 to 2,500 feet, and is walled by higher mountains—the Ogilvie Range on the north, the Mackenzie Mountains to the east, and the St. Elias and Coast Ranges on the southwest. To the northwest the Plateau continues into Alaska. The area is drained by the broad Yukon River and its several tributaries, the Teslin, Lewes, Pelly, Stewart, White, and Klondike, all of which have incised themselves 1,000 to 1,500 feet below the main upland surface, and flow at this lower elevation in broad flat-bottomed valleys. Two smaller basin-like areas which are drained by the Porcupine and Peel Rivers lie to the north of the main plateau, and a third drained by the headwaters of the Liard River lies to the southeast.

The best known and most developed part of the Yukon is within the central plateau region.[1] It is an area of rolling uplands, the summits of which show a uniformity of elevation. Isolated mountains and small ranges rise above the plateau level in places. Upstream from Dawson, the lower valleys of the main rivers spread out in a great branching system, which, in turn, drains similar large valleys occupied by small streams. The latter large tributary valleys have not been cut by the present small streams but are the result of erosion by glaciers or glacial streams during the last Ice Age.

An understanding of the main physiographic features and glacial history of the region is fundamental in discussing agricultural possibilities. The tributaries of the Yukon River rise in high mountains around the plateau and gather volume quickly, but when they reach the lower depressions, their gradients decrease and they flow peacefully through broad valleys. This factor has not only given Yukon an amazing network of branching navigable waterways, but has also meant that much level land is available for possible agriculture along the broad flood-plains of the rivers.

Physiography has also limited the amount of forest cover which has developed. Since

1—*The Yukon Territory*, Bureau of Northwest Territories and Yukon Affairs, Dept. of Mines and Resources, Ottawa, 1944



orth of Frances Lake



Looking southward up the Donjek River, tributary of White River. The St. Elias Range in the background

most of the Yukon is mountainous or plateau-like, there are large areas of tundra above timber-line, which is at an altitude of about 5,000 feet in southern Yukon. There are also extensive sections supporting a growth so stunted that its chief value is as a cover for game or fur animals. Merchantable timber stands, except in the extreme south, are chiefly confined to the river and stream valleys where there is a combination of good soils, sheltered conditions and low elevations.

Climate

Climatically, the Yukon is probably less favoured than the lower-elevation valleys of the Mackenzie River system. Because of the generally higher elevations of the Yukon plateau, temperatures are lower in both winter and summer, although the valley bottoms may become quite hot during summer days. Average annual precipitation is light because of the interior position of the plateau which is cut off by mountains. Meteorological stations with long periods of record are few in the Yukon, thus climatic data on a regional basis are scanty. The figures available represent lowland conditions where general farming or gardening is possible rather than the higher upland or mountain areas.

Mean monthly summer temperatures of 50 to 60 degrees are recorded at Dawson, Carcross, and Mayo, and mean daily maximum temperatures rise to 65 to 73 degrees on a monthly average during the summer. Shorter periods of records at Whitehorse, Frances Lake, and Watson Lake have similar averages. An extreme maximum of 95 degrees recorded at Dawson is the highest known in the Yukon. Average maximum temperatures during a summer month usually reach 80 to 85 degrees. Summers could thus be called cool, with occasional hot spells.



The Yukon Plateau near the Alaska boundary, along the Alaska Highway

R. C. A. F. photos

Mean monthly winter temperatures show greater variety, depending upon the location of the station. They range from 0 degrees in January at Carcross and Frances Lake to -13 degrees at Mayo and -21 degrees at Dawson in January. Extreme minimum temperatures of -67 degrees have been recorded at each of the three long-period climatic stations and monthly minimum temperatures, on the average, drop to around -50 degrees at most of the stations.

Average annual precipitation is low in the Yukon, ranging from 9 to 13 inches. It is more effective, however, than in areas farther south in Canada since lower temperatures result in less evaporation. About 35 to 50 per cent of this total falls during the four summer months. Because of the topographical barrier of the St. Elias and Coast Ranges, southern Yukon appears to receive less precipitation than the west central section. All stations record monthly averages of less than two inches of rainfall, which is a warning that agriculture may be a precarious industry in some years.

The average length of the frost-free period is a measure of the future agricultural possibilities that a region may have. Since there is a range of almost two months between the recorded dates of the earliest and latest fall frosts, it is apparent that this average period can be greatly extended or contracted in certain years, and therefore has its chief value for comparative purposes. Southern Yukon, with higher elevations, as illustrated by Carcross and Whitehorse, has an average frost-free period of only 45 days, while Dawson and Swede Creek, in central Yukon, have an average of 75 days. Average spring frosts occur in early June in west central Yukon and after mid-June in the southern areas. Average fall frosts are recorded around August 20 in the Dawson area, as compared with August 10 in the vicinity of Whitehorse. The first fall frost has always been recorded before September 15 at all Yukon stations. These data indicate that crops which mature in 70 to 75 days, and which can tolerate night temperatures below 43 degrees Fahrenheit, have more chance of success.

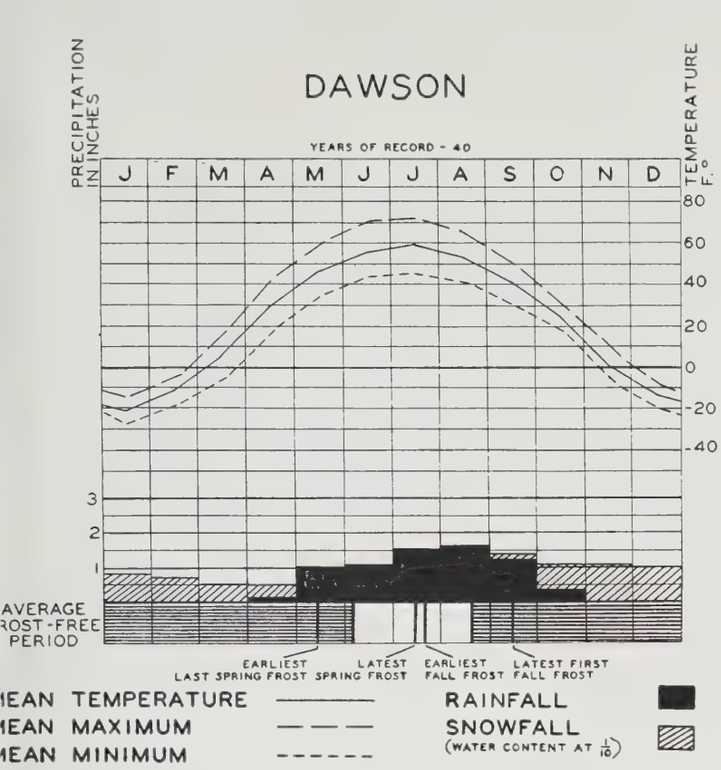
Soils

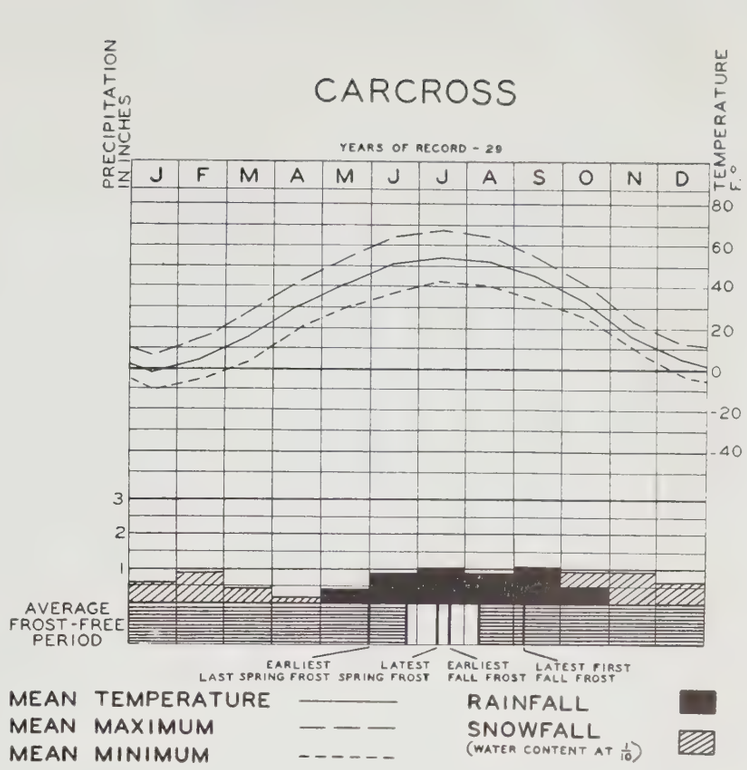
Soils are not deeply weathered in the Yukon since soil forming processes work slowly, owing to the small amount of rainfall received and the severity of climate. Although most of the agricultural soils are tree-covered, strangely enough they do not have the leached layer which is characteristic of wooded soils.

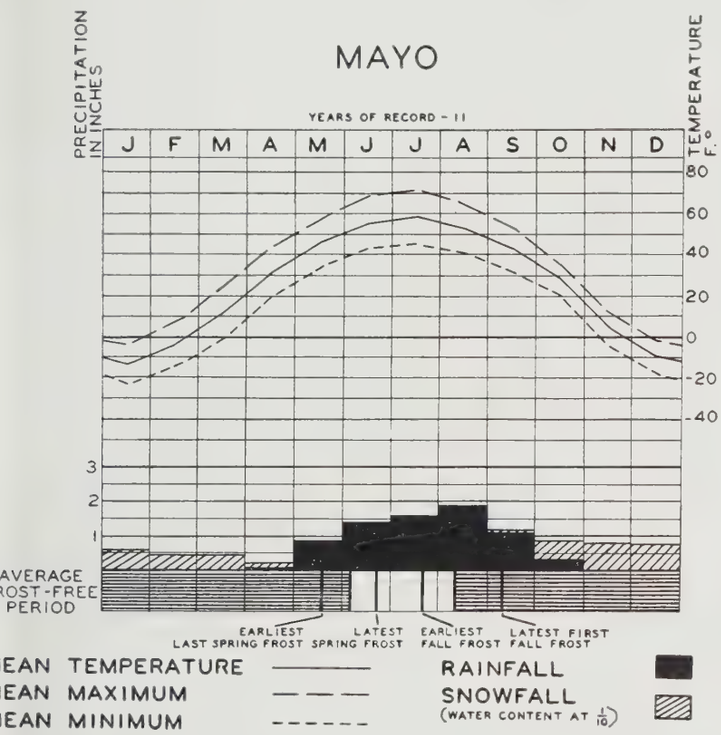
Reconnaissance surveys indicate that surface soils have two predominant colours which are illustrative of drainage conditions. The reddish-brown soils are well-drained, while black or dark grey soils are poorly drained. The soils are derived from a variety of rocks so it would appear that mineral plant food is sufficient. Soil tests show that organic matter tends to be on the low side for many soils with agricultural possibilities. The sandy, non-agricultural soils are decidedly acidic, and the better soils are slightly acid to alkaline in reaction. Under cultivation and cropping it has been found that yields on upland soils decreased rapidly after a few years unless fertilizer was added.

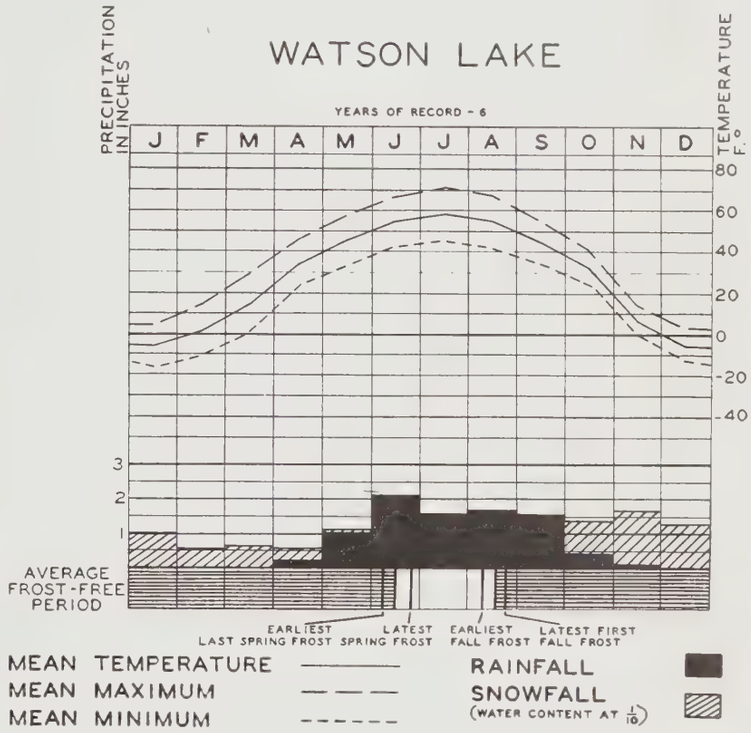
The soils considered as having agricultural possibilities in southern Yukon valleys are not classed as permanently frozen, although permanent frost has been found at a depth of 25 feet at the Whitehorse airport. In the Yukon Valley north of Carmacks, frozen soils are more common, especially on northern slopes. Around Dawson and Mayo even the lowlands and southern slopes have permanent frost within a few inches of the surface unless the land has been cleared or burned over. This zone of permanent frost, which is similar to that covering other large areas of Northern Canada and the northern Soviet Union, places additional difficulties in the way of agriculture.[2] Although it has been proved that crops can grow above permanently frozen ground, they do better if the soil is thawed to a depth of three to five feet.

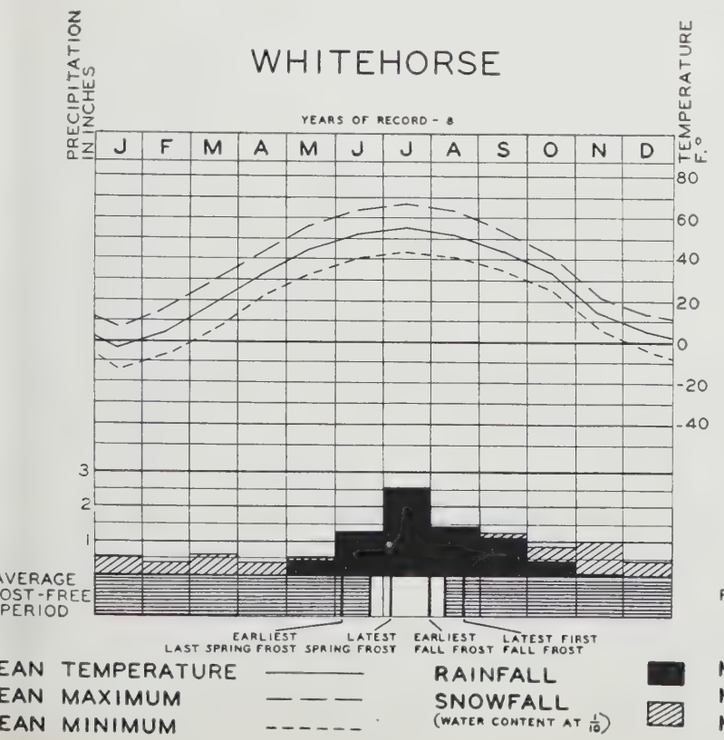
[2]—Robinson, J. L. "Land Use Possibilities in Mackenzie District, N.W.T.", *Canadian Geographical Journal*, July, 1945.

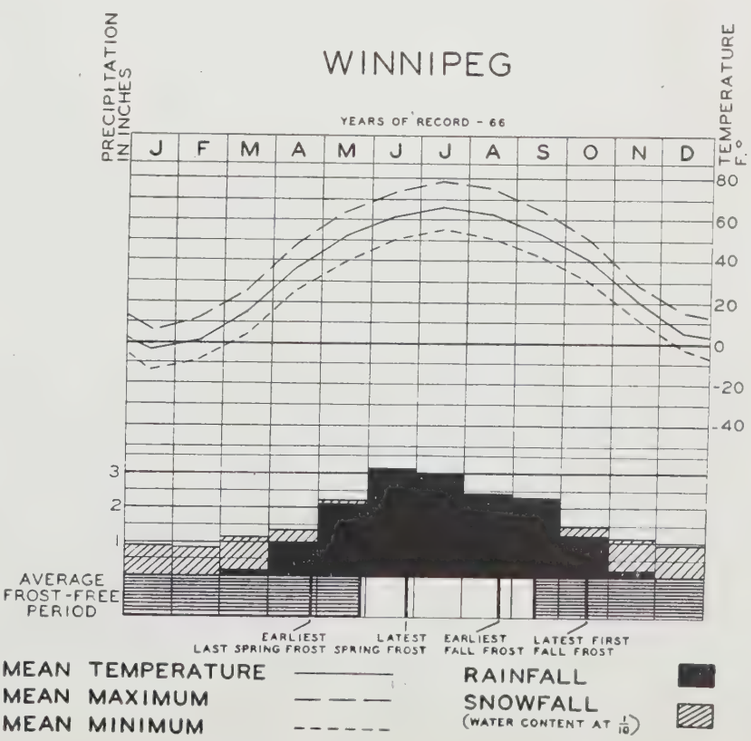












Charts by J. Lewis Robinson

Forests

South of latitude 64 degrees the Yukon is fairly well forested, although it is not rich in timber values. The southeastern section contains the largest portion of the forest resources and could supply a large amount of timber for other parts if it were needed. Central Yukon appears to have sufficient timber for present local needs and some limited future expansion. It is doubtful if any timber of commercial value occurs north of latitude 64 degrees but stands suitable for cabins and firewood are fairly well spread along the river bottoms. The northern Arctic Coast is a tundra area, beyond the northern limit of tree-growth.

In general, the forests belong to the Northern or Boreal Forest Region, and the most important timber species is white spruce.[3] Black spruce is also widely distributed. There are, however, two species, alpine fir and lodgepole pine, which are commonly found in the forests of the Cordillera or western mountains, and which run through a considerable part of the Yukon.[4]

Our knowledge of the ranges of the various species of trees making up Yukon forests is as yet imperfect, but generalization is possible. White spruce is the only tree being used commercially to any extent. This species reaches its best development on rich river-bottom soils. It furnishes practically all of the lumber used locally and the bulk of the fuelwood supply for both the river steamers and residents' homes. Black spruce occurs more commonly in the muskeg areas of southeastern Yukon, along the Canol Road, and in the muskegs of the Kluane Lake and White River regions of the southwest. The species is of no commercial importance since it seldom grows to a usable size in this region.

Alpine fir is fairly definitely limited to the central and eastern parts of the Yukon. Since it is a moisture-requiring species, much can be deduced concerning general climatic conditions by studying its occurrence within the Territory. Its westerly limit appears to be along a line drawn roughly from 40 miles east of Dawson, southeasterly to Tagish Lake.

The range of lodgepole pine is somewhat westward of that of alpine fir. It is the predominant species in the vicinity of Whitehorse, where it is used a great deal for firewood and in some places reaches sufficient size to furnish railroad ties. Other forest species which have been noted in local pure stands or in combinations with others are eastern larch, balsam poplar, aspen, and white birch.

Southern Yukon

Since soils and forests are indicative of what the land can produce, a regional summary of this information will illustrate some of the resource possibilities of the Yukon.

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[3]—Halliday, W. E. D. *A Forest Classification for Canada*, Canada, Dept. of Mines and Resources, Forest Service Bulletin 89, 1937

[4]—Raup, H. M. "Forests and Gardens Along the Alaska Highway", *Geographical Review*, January, 1945.

A broad, forested valley along the Canol Road, near Sheldon Lake, Yukon U.S. Army photo



Looking southwest from south fork of Macm in foreground, black spruce in distance



The Liard watershed in southeastern Yukon and northern British Columbia contains the best timber found in the area. The river benches have soils of agricultural possibilities, but the cost of clearing would classify this area more economically as a future timber area. The best stands are in the valleys, but the uplands, up to an elevation of about 3,500 feet, also support timber of very good quality. Some of the merchantable stands west of Watson Lake are from 100 to 135 years old, and run from 15,000 to 30,000 board feet per acre. Forest fires have not been extensive or frequent in the area. The general rate of growth is reasonably good in the Liard watershed and it contains sufficient reserves of timber to furnish an exportable surplus to either Mackenzie District or Yukon in the event that transportation facilities make this feasible.

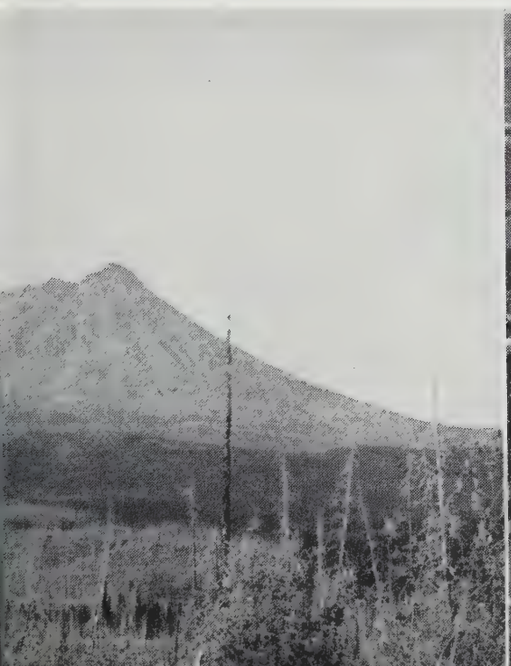
Farther west along the Alaska Highway there are merchantable stands of spruce in the vicinity of Teslin Lake and along the Nisutlin and Teslin Rivers. These stands also extend into the uplands to elevations of approximately 3,500 feet. Because the climate is drier this area has suffered more from fire, and timber is not as large or extensive as in the Liard watershed. Stands of spruce of good quality are typical of the bottom lands, and lodgepole pine in pure, or almost pure, stands is found on the uplands.

Soil surveys indicate that there is some good soil near the north end of Teslin Lake which might be suitable for gardening, and would also make good grazing land. Open meadows are common, and wet meadows are conspicuous along drainage channels. Soils and vegetation indicate that the area is too dry for agriculture, but there would appear to be an abundance of native forage which would cure well to winter live stock.

There are soils at the north end of Tagish and Little Atlin Lakes which, while not first class, are possible farm lands. Tagish flats have about 6,000 acres of mixed soils of a generally heavy texture. The vegetative cover varies from open grassland to dense spruce stands, suggesting a diversity of soils, some of which are good, but all appear to have a poorly drained subsoil. By using the criteria of soils and vegetation to determine proper land use in this area, it would seem that subsistence farming, utilizing the grazing lands and local woodlots, would be possible for a small-scale beginning.

Northward along the Canol Road tree growth is generally small. Limited areas of merchantable timber are found along some side creeks, and also at Quiet Lake, Lappie River, and Sheldon Lake. United States contractors had portable sawmills at the latter two locations during the construction of the Canol pipeline and road, and cut one million board feet of lumber, 144,000 linear

owards Mount Sheldon. Burnt over area
Photo by F. H. R. Jackson



Plateau surface and sharp peaks of the western sections of the Mackenzie Mountains. Sheldon Lake and Mount Sheldon in the centre background
R. C. A. F. photo







The Canol Road crossing over Pelly River near Ross River post. Note the bare hillsides burnt over twenty years ago.

Photo by F. H. R. Jackson

feet for telephone poles, and 3,000 cords of dry fuelwood. With lumber needs for the Canol Road now fulfilled, it is doubtful if there will be any market for the smaller trees found in the river valleys along the road.

In the Carcross area, south of Whitehorse, land use possibilities are limited by sandy soils, dry climate and unfavourable topography. Open range is plentiful but arable hayland is less common. For some time cattle and horses have grazed and overwintered here with little or no supplementary feed. Some farming on a few acres has been carried on at the Carcross Anglican Mission. There is adequate timber in the Whitehorse-Carcross area for domestic fuelwood supplies using seasoned pine, but hardly enough for any extensive lumber industry, and the danger from forest fires is always a hazard.

The largest continuous block of potential agricultural land lies in the Takhini-Dezadeash Valleys, west of Whitehorse. The two drainage systems form one valley about three to four miles wide and 100 miles long. Topography is generally level to gently rolling, sloping slightly to the south where the major streams flow. The eastern end of the valley is slightly more rolling, with a sand dune area found near Champagne. Average altitudes of the valley are about 2,200 to 2,400 feet above sea-level.

The valleys were probably once occupied by two post-glacial lakes, which deposited layers of clay in the central sections while sand and gravel beaches accumulated near their edges. When the lakes finally disappeared, the present drainage system cut through the lacustrine deposition and laid its own clays and silts along the modern river flats. Thus the most mature soils are now found on the uplands and are generally stone-free and of good quality. They cover about two-thirds of the valley and are potentially general farming soils. The immature clays and sands of the lower benches near the rivers have grazing possibilities. Samples of soil taken under bunch grass in burned over areas have the appearance of a dark brown prairie soil, similar to that found in the Prairie Provinces.

The vegetation of the valley has a park-like appearance. Spruce, either in solid stands or clumps, occupies more than half of it, and aspen, poplar, willow, and open grassy areas cover the remainder. Areas will have to be cleared for extensive farming, but this would not be as costly as in some other parts of the Yukon.

The greatest danger to future agricultural development in the Takhini-Dezadeash area will probably be the dry climate resulting from the position of the valley in the leeward of the high mountains of south-western Yukon. It is possible, however,





A dense stand of small black spruce, found along the Canol Road at Ross River. Photo by F. H. R. Jackson

Left:—Looking southward over the Ross River Valley and the Canol Road. Note the broad valley and small stream. R. C. A. F. photo

that moisture-bearing winds reach the valley from the Pacific through the Alsek gap in the St. Elias Mountains. There is an additional hazard from late spring and early fall frosts because of its plateau altitude. Agriculture has never been attempted in the area despite the proximity of a large market at Whitehorse. With these facts in mind, in 1944 the Dominion Experimental Farms Service selected a site for an agricultural sub-station at Pine Creek, near the junction of the Haines cut-off road with the Alaska Highway, and will begin operations there this year. The results obtained at the sub-station will be watched with interest as bearing on the future possibilities of the extensive area.

In the area around Kluane Lake and the headwaters of White River, the permanent frost zone is near the surface impeding drainage and restricting forest growth. White spruce and balsam poplar are the only species much in evidence; the former occupies the lower levels and the latter forms generally pure stands of stunted trees at the timber line. The scenic mountains and snowfields of this rugged region, which contains the highest peaks in Canada, form a real tourist attraction,[5] and an area of some 30,000 square miles was set aside in 1943 for consideration as a National Park. The characteristics which give scenic grandeur to the area at the same time limit the soil and vegetative resources. In reserving the region as a game sanctuary and National Park, however, its only known resources are being protected and utilized.

Central Yukon

There are no outstanding timber areas along the Yukon River trench between Whitehorse and Dawson. The bottomlands and valley sides, however, are fairly well wooded except on the rocky hills at Lake Laberge. Spruce timber of any appreciable size is confined to the various tributary creeks and side draws. Beyond the junction of the Stewart River, growth appears to be more vigorous owing to more alluvial soil areas and greater precipitation. These stands have their chief value as a source of fuelwood for the river steamers. The forests along the river appear to be fairly adequate to maintain this supply, if traffic does not greatly increase. Population is sparse along the river between the two chief towns, and there is little direct land utilization. The forest cover serves its chief purpose in providing protection for the game and fur animals upon which the white and Indian trappers depend for a livelihood.

Between Carmacks and Dawson, potential agricultural areas are confined to local

[5]—Kitto, F. H. *Yukon, Land of the Klondike*, Dept. of Interior, Northwest Territories and Yukon Branch, Ottawa, 1930



A flat-bottomed, glacial valley along Ross River on the Canol Road.

U.S. Army photo

terraces composed of fine sands with heavier sections of silt and clay, and to river flats and islands covered with fertile silts. There is considerable grazing land near Carmacks, but further clearing of the good soils will be necessary to develop agricultural areas. The river flats along the Pelly River, which joins the Lewes from the east at Selkirk, appear to have fertile soils varying from sandy loam to silt loam overlying gravel. Agriculture in the Pelly River area, however, is largely a matter of economics, the chief problem being accessibility to local markets.

North of White and Stewart Rivers the benches and islands in the Yukon River become more numerous. Many of these areas used to be farmed before the decline in population in the Dawson locality,[6] so it is known that the soils have good agricultural possibilities. There is additional agricultural land on the gentle slopes of the hills around Dawson. Soils range from a fine sandy loam to a loam and, where affected by seepage, are dark coloured. There are about 2,000 to 4,000 acres of tillable land on the slopes, of which probably 300 to 500 acres were once cultivated in productive farms. The future use of land in the Dawson area is hindered less by climate and topography than by lack of consistent local markets and competition from imported food stuffs. Expansion will greatly depend upon the development of other resources or facilities.

The low rounded hills and flat-bottomed valleys around Dawson are sparsely timbered. Trees rarely exceed six to eight inches in diameter except in favoured locations. The sawmills which operated there during the mining boom exhausted most of the nearby lumber supply, leaving few areas readily accessible to Dawson which support a tree growth suitable for the cutting of fuelwood on a commercial basis. Most of the logs are now rafted down from the Klondike and its tributaries, and also down the Yukon and Stewart Rivers. There is timber on the west side of the Yukon River near Dawson, but this wood cannot be hauled across until the river ice is safe for travel in January, and this causes inconvenience if local reserves are not large enough.

The Stewart River Valley is well forested, but merchantable stands are not frequent partially due to the irregular width of the valley. Low areas of swampland and muskeg occur in the wide sections. Higher slope elevations (1,650 to 3,000 feet) support pure and mixed stands of spruce and poplar. The chief timber areas are on the alluvial lands of the lower reaches of the small tributary streams, the islands, and narrow strips along the river banks.

The volume of timber cut along the Stewart River has declined since the steamboats curtailed their period of operation. Fuelwood is still cut in a few small

6—Ogilvie, Wm. *Early Days of the Yukon*, Ottawa, 1913.

camps, however, to be rafted downstream to Stewart settlement to supplement supplies required for the Yukon river boats. Prior to 1940 the Treadwell-Yukon Mining Corporation cut timber from Mayo Lake for many years without disturbing the total stand to any appreciable amount, and it is probable that there is enough scattered timber along the Stewart River and its tributaries to assist any future mining development. Although the two Mayo sawmills were once busy, using logs from above the town, they now each turn out only about 100,000 board feet annually, most of which is shipped to Dawson or Whitehorse. The Mayo area requires about 3,000 cords of fuelwood annually when the mining camps are active, but about 500 cords are sufficient for the local residents.

Good agricultural soils are found on river flats along the Stewart River between McQuesten and Mayo, but most of them are fairly heavily covered with spruce. In addition to the necessity of clearing sections, the agricultural possibilities of the Stewart Valley are further limited by the shallow depth of unfrozen soil. The silt soils of the Mayo Basin are excellent for gardens, however, and the town is able to supply most of its own vegetable needs. At present the Mayo-Keno area is primarily a mining region,[7] and the soil and forest resources are of less importance but are utilized for local gardening and lumber supplies.

Experimental Work and Field Investigations

The geographic factors of the Yukon have enabled the region to maintain an adequate forest growth and also permitted general farming when markets were available. An estimate of future possibilities can be based upon the results of past experimental work and present field investigations. Co-operative agricultural trials have been conducted since 1915 at various places in the Yukon by the Dominion Experimental Farms Service. Experimental work done from 1917 to 1925 at Swede Creek, on slope land seven miles west of Dawson, illustrated certain facts concerning agricultural possibilities in the Dawson area. Good crops of wheat, oats and barley matured in most years, but occasionally early frosts made it desirable to harvest these crops as cereal hay. Experimental work with forage crops showed that timothy and alfalfa were reasonably successful although alfalfa did not produce seed. Red clover was usually winter-killed. Brome grass was proved to be the most successful tame grass and at present occupies most of the farm acreage in Yukon Territory.

Further experimental trials at Carmacks (1932-34) and Carcross (1936-38) resulted in successful garden crops of most root and leaf vegetables. Grasses, clovers, and cereals had varying success, with summer frosts proving to be a serious hazard. The numerous other duties of the co-operator

7—Bostock, H. S. *Mining Industry of Yukon, 1939 and 1940*, Canada, Dept. of Mines & Resources, Mines and Geology Branch, Geological Survey Memoir 234, Ottawa, 1941.



ıb-alpine growth of hite spruce on Ross ver near Lappie ıss
Photo by F.H.R. Jackson



Good forest growth along Little Rancheria River, southwestern Yukon

at the Carcross Anglican Mission resulted in discontinuance of the experimental work in 1938.

No further experimental work was attempted in the Yukon until 1945. The small population was mainly concerned with mining activity, and their local gardens and a few farms supplied most of their own needs. Wartime activity, however, brought new life to the Yukon. Construction of a line of air-fields leading to Alaska, the Alaska Military Highway and the Canol Pipeline brought a great influx of people. As part of the programme of field work, which is being undertaken to obtain more accurate knowledge of the possibilities of northern Canadian resources, Dr. A. Leahey, Senior Soil Scientist with the Experimental Farms Services, was sent north in 1943 on the recommendation of the Interdepartmental Committee on Agriculture for Northwestern Canada.[8] Leahey conducted a broad reconnaissance soil survey of the northwestern regions in the company of Dr. V. C. Brink of the University of British Columbia, who studied grazing possibilities. As a result of this field work, which was supplemented by a further short visit in 1944 to pick a site for an Experimental Sub-Station, certain generalized information is available concerning soil conditions and agricultural possibilities in the Yukon.

The forest resources of the Yukon and Alaska Highway were investigated by officers of the Lands, Parks and Forests Branch during the summer seasons of 1943 and 1944. General reconnaissance work was carried on by H. L. Holman of the Dominion Forest Service by car, boat and plane in south and central Yukon during 1943, and further studies were conducted in 1944 in the Mayo area and along the southern part of the Canol Road by F. H. R. Jackson, of the National Parks Branch.

Present-day Agriculture

As would be expected, farms are not large in the Yukon. Of the 26 farms, totalling 2,781 acres, listed in 1941, only two were larger than 300 acres (not necessarily cultivated), while the rest were under 200 acres, and one-third of the total farms were less than 50 acres in area. The 26 farms were all run by owners and none were

8—This Committee was formed in February, 1943, and comprises representatives of the Departments of Agriculture and Mines and Resources, under the chairmanship of Dr. E. S. Archibald, Director of the Experimental Farms Service.

rented. The farms were classified as follows:

Grains and hay	5
Potatoes, roots and other field crops	6
Vegetables, fruit, nursery	3
Live stock	2
Subsistence	3
Part-time	6
Mixed farming	1

Most of the general farms are planted predominately in brome grass for hay. Yields vary from one to two tons per acre, but amounts decline unless the stand is rejuvenated. In addition there are smaller areas of wheat, oats, barley, alfalfa and potatoes. Farm income is derived chiefly from the local market for milk, butter and beef. Grain crops are usually grown for green feed, although they will ripen in all but unusual years of early frost. For comparative purposes, it is interesting to note the kinds and amounts of crops grown in the Yukon in 1931 and 1941:

	1941	1931
Cultivated area	511	778
Oats	27	63
Wheat	0	8
Cereals for hay	44	72
Cultivated hay	392	558
Other forage crops	0	3
Potatoes	47	69
Field roots	1	5

The minor importance of present agriculture in the Yukon, and its decline, is further illustrated by the following statistics:

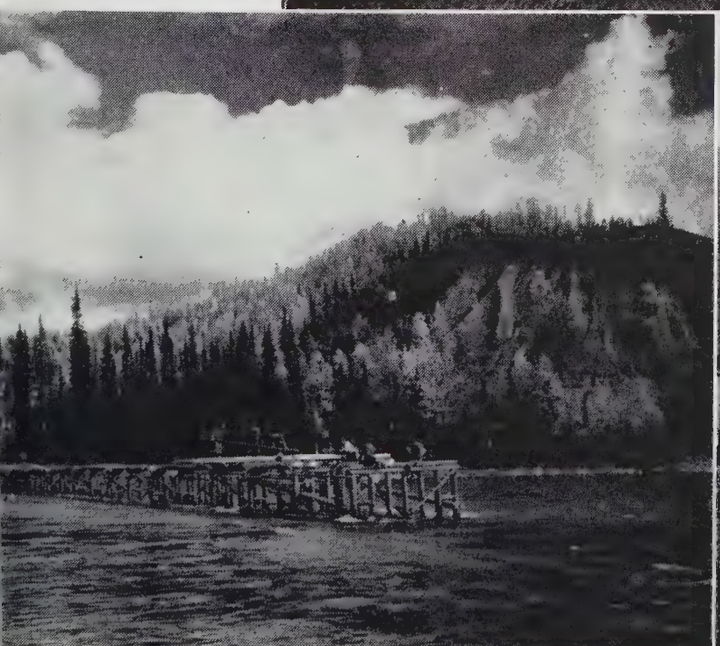
	1941	1931
Total farm value	$85,440	$127,459
Area in acres	2,781	5,197
Area under crops	511	778
Number of farms	26	41
Farm population	42	74
Number of horses	90	62
cattle	52	72
swine	72	41
chickens	138	224

t:—
n grassy valley and sted slopes on the de between Nisut- nd Teslin Rivers
Photo by F. H. R. Jackson

er right:—
anol Road bridge Teslin River. For- rowth is not dense.

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U.S. Army photo



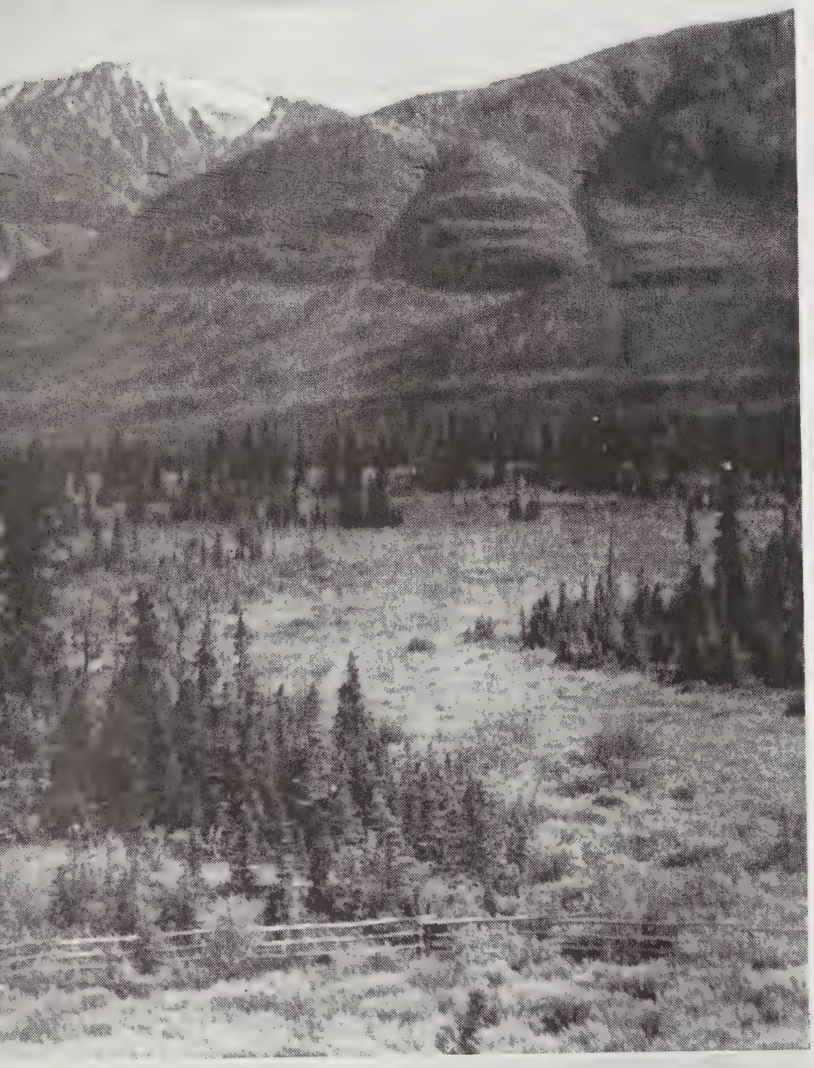








Above:—The wide, gravel flood-plain of Duke River, draining the St. Elias Mountains near the Alaska boundary.



Although gardening is at present well established in the Yukon, general farming is in poor condition. The better soils and more favourable climate appear to be in the west central sections, while agriculture in the more populous areas of southern Yukon is limited by unfavourable topography and drier climate.

It is difficult to estimate the amount of arable land which is at present available for future agricultural development since much of the land has not been investigated in detail. Experts believe, however, that there is probably a half-million acres capable of cultivation, but about half of this should be economically classed as forest land. The largest single agricultural section is about 100,000 acres in the Takhini-Dezadeash Valley, while there may be as much as 60,000 acres along the Yukon River flats.

While general farming in the Yukon is greatly hindered by lack of markets to utilize the products grown, grazing has greater local possibilities. This is particularly true of the southern Yukon valleys where grass appears better and many open areas are found. In many places it is possible to winter horses on the grazing flats owing to the small amount of snowfall. The big game possibilities of the Kluane Lake area have meant that numerous horses have been



Left, top to bottom:—Part of the Alaska Highway through a possible agricultural area in the Takhini Valley

Good grazing country in the open wet meadows near Burwash Landing and Kluane Lake

Photo by C. H. D. Clarke

Alaska Highway crossing Aishihik River in the Dezadeash Valley.

pastured in this area to supply tourists with pack-horses. The new agricultural sub-station at Pine Creek intends to experiment with various varieties of grasses and legumes and most suitable types of beef and dairy cattle, in addition to general farm and garden practices. Scientific information should thus soon be available for any future grazing industry.

Gardening

Yukon gardening is an established and flourishing activity. It is quite possible everywhere where soils are good, and, in the chief settlements, gardens supply most of the vegetable requirements of the population. Dawson residents, in particular, have developed gardening to an extent that the nearby farmers have a serious problem in trying to dispose of their garden produce in the town. The situation is somewhat similar in the Mayo area, but Whitehorse has been limited by the sandy character of the townsite and has not been able to grow all of its own vegetables.

The ordinary varieties of vegetables are raised successfully throughout the Yukon and include peas, lettuce, rhubarb, carrots, beets, cauliflower, cabbage, brussels sprouts, parsnips, celery, beans, radish, Swiss chard, turnips, parsley, broccoli, pepper grass and, in large quantities, potatoes. In addition, numerous small greenhouses in Whitehorse, Dawson, and Mayo are used to produce tomatoes and cucumbers and, in early spring, to start such vegetables as cabbage and cauliflower. Small fruits grow wild throughout the Territory and are preserved in quantity by the local residents. Those most commonly used are red raspberries, black and red currants, gooseberries, cranberries, and fine quality blueberries. Wild strawberries are not plentiful, but grow in some areas.









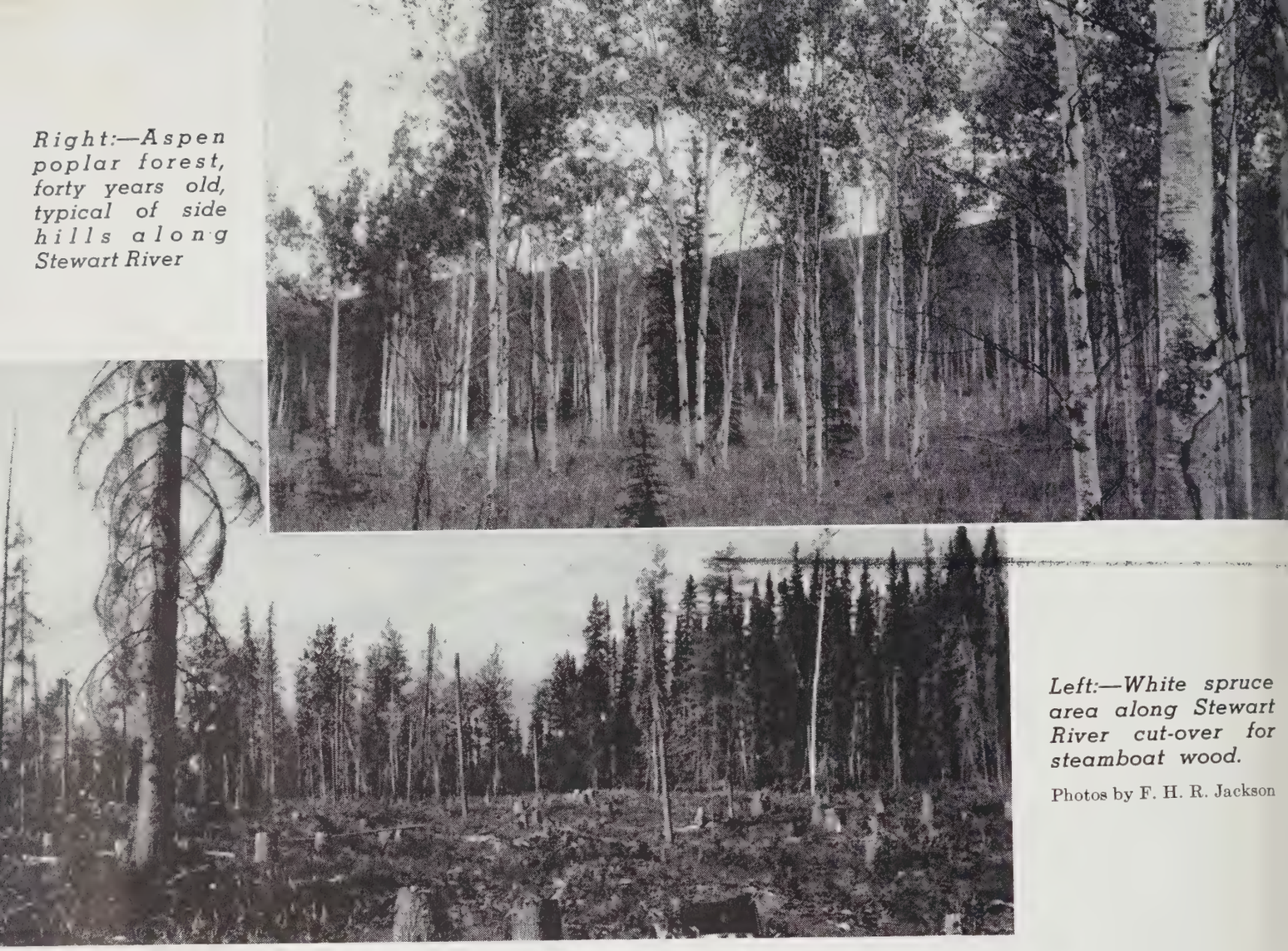
Right, top to bottom:—

Kathleen Lake in the St. Elias Mountains from the Haines cut-off road Photo by C.H.D. Clarke

Across the Klehini Valley towards the snow-covered St. Elias Mountains Photo by C.H.D. Clarke

Wide, forested valley along Upper Snag River, near the Alaska boundary Photo by C.H.D. Clarke

Forested hillside at Mayo Lake. White spruce in the foreground Photo by F.H.R. Jackson



Right:—Aspen poplar forest, forty years old, typical of side hills along Stewart River

Left:—White spruce area along Stewart River cut-over for steamboat wood.

Photos by F. H. R. Jackson

The resident manager of the Pine Creek Experimental Sub-Station plans to visit Yukon gardeners during the summer and give assistance and advice as to choice of more suitable varieties of vegetables and best types of fertilizers. Since gardening will probably be of continuing and increasing importance to the residents, every encouragement will be given to those who wish to co-operate.

The long days of summer give a great impetus to growth of all kinds, and numerous flowers in particular add colour to the Yukon landscape.[9] In mid-March the northern crocus appears, and by June wild roses are blooming throughout the valleys. In the same areas Siberian orchids thrive along with lupines, violets, anemones, harebells, poppies, buttercups, and many other flowering plants. Variety is the theme of Yukon gardens, which are the hobbies of most residents and a surprise to strangers. Almost every known variety of garden flower is raised to maturity, but sweet peas, nasturiums and pansies are particular favourites.

Forest Utilization

The forest resources of the Yukon are available for greater exploitation if increases in population warrant it. South of latitude 65 degrees, in an area of about 110,000 square miles, it is estimated, from reconnaissance field work and aerial photographs, that about 15 per cent of the region may be considered as normally growing forest; 35 per cent is classed as unproductive forest or scrub, leaving the remaining 50 per cent as water, tundra or barren. The timber areas are in strips along the chief rivers and flat bottomlands and thus have fairly high local accessibility. It is probable that these Yukon forest resources could sustain an annual cut of 50 to 100 million board feet under present conditions—a large and important reserve for future development.

The amount of timber cut in the Yukon is but a small part of that which is

[9]—Black, Mrs. George. *My Seventy Years*, Toronto, 1938.

produced by the forests. The total annual timber cut under permit during the past ten years is shown in the following table:

Year	Board Feet	Cords
1934–35	67,000	9,739
1935–36	185,000	11,946
1936–37	483,760	16,401
1937–38	400,000	19,677
1938–39	671,576	17,888
1939–40	351,157	15,387
1940–41	306,000	19,531
1941–42	300,000	12,847
1942–43	1, 305,000	13,658
1943–44	1, 408,657	20,403

The preceding table mirrors the increased amount of timber used during the past few years to assist the various Yukon wartime activities, but it does not include a much larger amount which went directly into defence projects, free of permit requirements. In 1943–44 there were 14,500,-463 board feet, 618,123 linear feet, and 49,-356 cords of wood cut for the various construction works. Most of it was taken from along the Alaska Highway west of Whitehorse, and over 90 per cent of the fuelwood was dry wood from the Whitehorse area, thus cleaning up large areas of fire-killed and normally unmerchantable timber. Cutting will decrease in 1945 since construction work is virtually complete.

From the total of about 150,000 cords of fuelwood cut in the past ten years, almost 50 per cent has been used by the river steamers, and the remainder for domestic heating. It is estimated that the large Yukon river boats use about 100 cords of wood for a round trip of 930 miles and have probably used about 300,000 cords of fuelwood from the Yukon Valley in the past 40 to 45 years. Attempts to utilize the low-grade coal from Carmacks for boat fuel have not proved satisfactory. Other Yukon coal deposits have not been fully investigated as to the possibility of replacing wood as fuel. Since local costs of labour and transportation are high, and fuelwood is abundant and accessible, it is doubtful if coal can replace wood for this purpose. Fuel oil is also too expensive to compete economically with wood at $10 per cord for the river steamers.

Although there are comparatively large reserves of standing timber in the Yukon, and a fairly high potential yield, the prospects for greatly increased exploitation are not bright. Since the timber is located in long, narrow fringes along the water-courses, cost of logging operations will be higher than if the timber were found in more compact blocks. The forest products of Yukon can be marketed only in such places as cannot be more conveniently, and more cheaply, supplied from other sources. There are few such places. Even some of the lumber used at Whitehorse is imported from British Columbia through Skagway. Yukon itself would appear to be the chief market, but unless mining activity and other development increase only a small fraction of the annual growth will be used.

Conclusion

Agricultural and forest industries will hardly precede development; they can only follow. In southern Yukon, however, there will be greater possibilities of a fuller development if it is known that agricultural land is available nearby to complement any expansion. The forest resources are sufficient to supply timber for any increased activity. In central Yukon it would appear that there is enough land to produce food for an influx of mining population in the mineralized districts from Mayo westward to the Alaska boundary. At present these lands are unused, except for gardening. It is improbable that there is any extensive agricultural land in the region which might be developed into an agricultural community as in the Takhini-Dezadeash area farther south. On the other hand, the scattered character of good soils in the river valleys is an advantage in that some arable land may be near any future development in the lower Yukon Valley.

The future of agriculture and forestry in the Yukon is closely linked with the development of the other natural resources, and probably will always be dependent



Looking northeast over Whitehorse, Yukon. Lewes River in background

upon the present chief industry, mining. There has been little inducement for farmers to undertake operations due to marketing difficulties and uncertainties, lack of local labour, and competition from imported staple food products. A limited number of homesteads are available in the Yukon, but agricultural settlers are not being encouraged until more is known about the soils and climate of the area.

The physical factors of topography and climate give the Yukon forest and agricultural resources comparable to those of more southerly Canadian regions. The utilization of these resources depends chiefly upon future population trends. In order to assist land use planning in the Yukon some factual data regarding agriculture and forests have been presented in this article, and the systematic investigations of resources which have now been started will serve as a basis for further studies.

Town of Dawson, the Territorial capital White Pass and Yukon R.R. photos



ARCTIC SURVEY
IV. A YUKON DOMESDAY: 1944

BY

GRIFFITH TAYLOR

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ARCTIC SURVEY[1]

IV

A Yukon Domesday: 1944

1. The Yukon Basin from Whitehorse to Dawson City

The second part of my journey in north-west Canada began when I left Tuktuk on July 25 for Aklavik and Norman Wells. I had hoped to fly from Aklavik to Norman Wells, and so save a week's delay, but the planes are very irregular to the north of Norman Wells and it did not seem advisable to leave the *Distributor* until I was back in the regular "flying area." We left the flying field at Norman Wells at 4 P.M. on August 1, and flew across the river to Canol. Here, after a short stop to pick up passengers, the plane proceeded south to Fort Simpson, which we reached in about two hours. We flew at a height of about 10,000 feet at about three miles a minute, so that it was impossible to make detailed notes. There was, of course, no settlement, and the only variations in scenery were in the character of the streams and sloughs. Occasionally outcrops of rock were visible, reminding one of whitish rounded scales in a green hide.

We waited only twenty minutes at Fort Simpson Airport, which is some distance from the settlement, and then flew south-west over unoccupied country to Fort Nelson on the Alaska Highway. We could make out the "winter road," at times crossing from lake to lake, with one group of huts near Petitot River about sixty miles from Nelson. We landed at the huge airport of Muskwa (Fort Nelson) about 8 P.M. I stayed a day at Fort Nelson, and made a survey of the old fur-trading settlement, but it will be more convenient to consider this district after the Yukon area has been described. The distance from Nelson to Whitehorse is about five hundred miles, and we flew this between 8.30 P.M. and midnight.

Whitehorse has a position on the Yukon-Lewes River system which is analogous to that of Fort Smith; i.e., it is at the south end of the navigable portion of a huge river, and hence a town has inevitably grown up at this site. The Whitehorse Rapids lie about a mile above the town and were not a complete obstacle to traffic, since in the early days many scows and rafts floated down them *en route* to the Klondike gold-field.

The history of Whitehorse falls into two parts. The first is linked with the traffic crossing from the sea by the railway to its terminus at Whitehorse, where cargo was transhipped to steamer or winter road. The second phase began about March, 1942, when the first American engineers arrived. Three great enterprises resulted from the war with Japan. First, a very large airport was built on the high, flat terrace behind Whitehorse; second, depots for use in connection

[1]The first two papers in this Arctic Survey by G. J. Wherrett and Andrew Moore, together with a foreword by H. A. Innis about the project as a whole, were published in the February number of this Journal. Part III, "A Mackenzie Domesday" by Griffith Taylor was published in the May number. A final paper by C. A. Dawson will be published in the November number.

with the Alaska Highway were placed here; third, Whitehorse became the terminus of the six-hundred mile pipeline from Norman Wells, and a large refinery was built here to process the oil. As a result the population of Whitehorse has grown almost as rapidly as did that of Dawson in the gold rush of 1897-8. Since the latter town has declined greatly, the two towns offer very interesting contrasts in urban development.



Fig. 1. The vicinity of Whitehorse—from a map distributed to the public.

The topography in the vicinity of Whitehorse can be understood by reference to the outline map shown in Fig. 1. This is based on a map distributed to tourists, and is really necessary to enable them to find their way about the extremely spread-out plan of modern Whitehorse. Below the rapids which appear at the extreme left of the map, the river expands into a sort of lake about half a mile long. This "lake" washes the foot of the remarkable bench (or terrace) of white clay, which rises some 200 feet behind the town. The airport has been constructed on the flat ground above this scarp, and the Alcan (or Alaska) Highway runs along the western edge of the airport. The White Pass Railway runs at the foot of the clay scarp, about 20 feet above the river. It suffers a good deal from small landslides which drop down the face of the clay scarp.

The modern town is built on the flat lower terrace or bench about 20 feet above the river, and this terrace expands to a width of over half a mile about a mile below the rapids (Fig. 2). Here a conventional plan of some eight roads at right angles to the river bank, crossed by seven roads parallel to the river, has been laid down. This portion of the town is all that I was able to survey, since the other three or four recent sections of the town were under military surveillance, and no sketching or photography was permitted near them. These are labelled "U.S. Army" or "Refinery" or "Airport" in Fig. 1. Two main roads have been cut up the steep scarp as shown. One leads to the airport, and the other, after about three miles, reaches the headquarters of the army on the Alaska Highway.

The normal white population of Whitehorse is about 500, but the influx of Americans and other folk connected with the new developments mentioned above, has given it a temporary population of 8,000. This is largely accommodated in barracks and tents in the areas labelled "U.S. Army" in Fig. 1. Many of

these temporary frame buildings have been erected in the southern corner of the town-plan, as may be seen by reference to Fig. 2, where the arrangement of the houses, shops, etc., is given in detail.

First Street lies about 200 feet away from the river bank, and the intervening strip carries the railway line, and the station, as well as a number of offices and warehouses. At the south end of the warehouses are a number of shacks, shown by dots in Fig. 2. At the northern end of this strip along the river is a row of old steamboats, pulled up on the shore and gradually falling to pieces. The central street at right angles to the river is Main Street; and most of the shops are to be found on this artery, or along the west side of First Street. As is often the case, the business portion of the town occupies a triangle based on the two

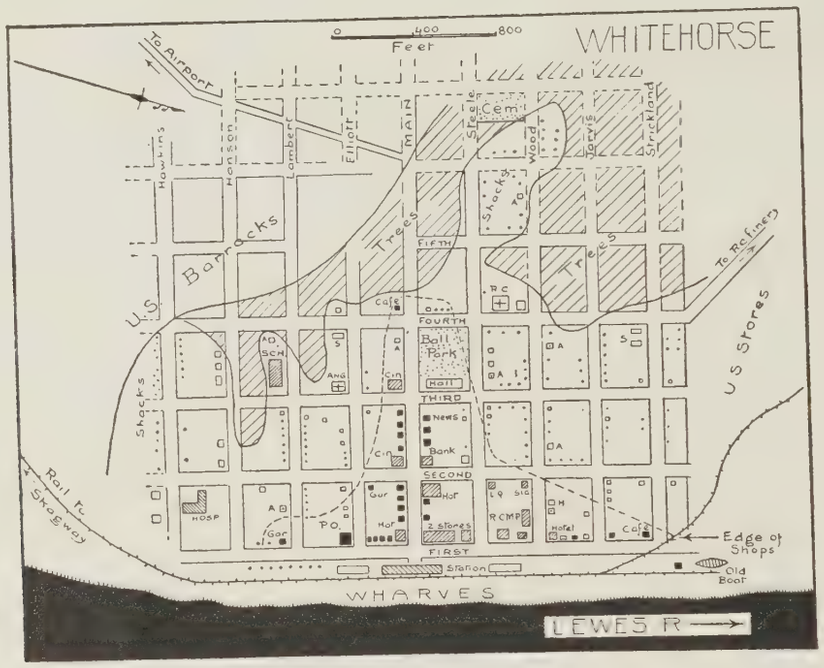


Fig. 2. A functional plan of Whitehorse. The important buildings are ruled; the shops are black; the better houses are marked A; shacks are shown by dots.

main streets. The post office, like many of the main shops, is a two-storey building, and is situated just south of the station. The largest stores front the station on First Street, while the leading hotel is a fine establishment of three storeys on Main and Second. Here also is the bank, while two cinema halls face the latter. There is a ball park with a large recreation hall at the apex of the "triangle" on Fourth Street. To the north-west of the station is the government block, containing the large police headquarters, the signals depot, and the liquor store. Two smaller hotels are situated on First Street.

A list of the smaller shops in this northern centre should be of interest. Along First Street are (from north to south), a café, tailor, telegraph office, drug-store, bakery, airlines, and garage. On the south side of Main Street are an electrician, realtor, jeweller, barber, and café; and on the north side, butcher, café, bowls, and tailor. The hospital is an imposing building of three storeys in the south-east of the town, and two blocks to the east is the large school.

Nearby is the interesting "Log Church" (Anglican), which is over forty years old. The Catholic Church is on Fourth Street, the main cross road leading to the north.

A glance at the map shows that a large portion of the original "checkerboard" of streets is still covered with scrub, especially in the west of the town. Near the cemetery are a number of shacks built by squatters, who pay no rent. As stated, the barracks of the Americans occupy what was formerly empty land in the south-west. In the sketch map I have tried to show the largest houses by the label "A." These are much scattered, though mostly in the north-west near the Catholic Church. The smaller houses and rather rough shacks are mixed together, though, as might be expected, the poorer houses border the town on the whole. The town of Whitehorse shows a definite segregation of the business section, and since there are now many factories at the refinery, but no definite zones of better-class houses, we may say that it belongs to the "adolescent" class of small towns.

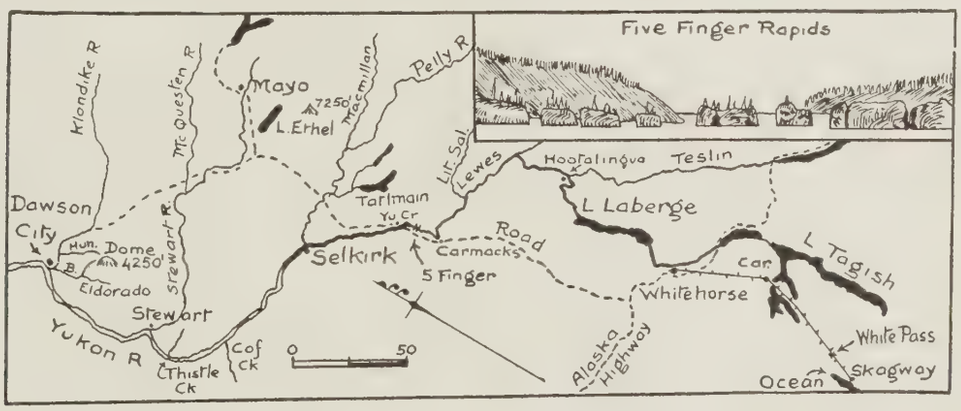


Fig. 3. Sketch map of Lewes-Yukon River from Whitehorse to Dawson City. Inset is a sketch of the rock-bar at Five Finger Rapids. The White-Pass Yukon Railway to the ocean at Skagway is charted also.

As earlier stated, Whitehorse is the southern end of navigation on the Lewes-Yukon Rivers. The sternwheel steamers anchor alongside the railway line at Whitehorse, and then steam south a few hundred feet to turn in the river just above the station, a ticklish job with very little room to spare at each end. We left at 6.30 P.M. on August 3 for Dawson City and Klondike. Cargo is carried in the holds and on the deck, and there are no scows to push along as on the Mackenzie.

The scenery along the river is often most picturesque, and very different from that on the Mackenzie (Fig. 3). The river flows into Lake Laberge about sixteen miles below Whitehorse. The lake is about three miles wide, with blunt pyramid peaks of gray rock rising about 2,000 feet above lake level (2,100 feet). The steamer skirts the eastern shore, and the lake is quite shallow in places. A small settlement of ten houses is situated on the eastern shore. The Teslin River flows into the Lewes from the east at Hootalinqua, and here there is an abandoned police station, a few houses, and an old decaying steamer pulled up on

shore. Quite unlike the views along the Mackenzie, were the steep, hilly, and at times mountainous, sides of the river valley. A fine series of terraces is present in places, reminding one of the characteristic features of the glacial valleys in central British Columbia. Fourteen miles below Big Salmon there are cut-banks formed of white varve clays 20 feet above the river, while some 500 feet higher there appear relics of another bench or terrace. Near Little Salmon there are similar terraces at about 20, 80, and 200 feet above the river. Just to the east of Carmacks the 45-foot scarp shows a very interesting geological section. At the base is about 15 feet of yellowish rubble covered by a foot or two of yellow varve clay. Above this is more coarse yellow debris, and a well-defined layer of about 2 feet of hard gravel. Above this again, is the top layer of 10 feet of white varve clay, in which are many nest-burrows cut by swallows.

The adits of several coal-mines are visible near Carmacks, one being on the east bank and several a little to the north on the west bank. We did not stop at Carmacks, where the overland trail from Whitehorse reaches the river. There was a population of thirty-two here in 1927, but it has fallen to half that figure today. Half a dozen houses, including two of two storeys, were clustered on top of the 12-foot bank. Behind was a wooded slope rising about 150 feet to another flat ridge. Among the trees on the slopes were four more log cabins.

The most scenic spot in the Yukon or Mackenzie basins, in the writer's opinion, is found at the Five Finger Rapids, which are about sixteen miles north of Carmacks (see inset in Fig. 3). Here the big river is barred by a wall of conglomerate, from 20 to 30 feet high, in which five narrow channels have been cut by the rapid waters. Only one of these is wide and deep enough for the steamer to pass through; and since the current is very swift here, the whole traverse is a matter of a minute or two. (On the return journey the steamer at times literally winds its way upstream along a chain fastened to the shore.) Such a wall-like barrier is not uncommon in a small river, but I know of no other similar obstruction, just like the concrete piers of a ruined bridge, on any river as large as the Lewes. About eight miles downstream is Yukon Crossing, where the good road to Dawson ends. But a trail on the east side of the river links the Crossing to Selkirk, Mayo, the Eldorado diggings, and Dawson.

Fort Selkirk is about the largest settlement between Whitehorse and Dawson City. The steamer stopped here for only ten minutes; so that I was unable to do more than make a panorama sketch of the settlement, which is strung out along the top of a 10-foot bank, much like those on the Mackenzie River. The fort dates back for a hundred years, but there are less than a dozen whites living there. There is the usual cluster of frame houses, painted white with the red roofs, which marks the Hudson's Bay centre. Taylor and Drury—a rival firm in the Yukon—have a fair-sized store at Selkirk also. At the west (lower) end of the village are two steepled churches; and there are about a score of other houses mostly log cabins, which complete the settlement. The white population comprises three folk at the Hudson's Bay store, three at the two Missions, two at the telegraph station, and two at the other store. The number of Indians varies

from ten to a hundred according to the season. According to our "Town Classification" Fort Selkirk is "sub-infantile" though a hundred years old.

Below Selkirk, where the large river Pelly enters from the east, the main river changes its name from Lewes to Yukon. The river is now about a mile wide on the average, though it varies in this respect a good deal. The velocity is about four or five miles an hour, and the steamer proceeds at about ten knots in general on its downstream course. (It is of course much slower on the return trip against the current.) At Coffee Creek were half a dozen houses on a flat, and here the steamer was stopped in response to a flag, waved from the bank by a pioneer woman clad in blue denim trousers. Near Thistle Creek there was time to inspect a most interesting garden cultivated by Mr. Israels. He has several fine horses engaged in hauling cordwood for the steamers. Many salmon are caught in the vicinity, and wolves and caribou are relatively abundant. On



Fig. 4. Functional plan of the dwindling town of Dawson City, Klondike.

his verandah in tins were flowering fuschias and geraniums, which were unexpected so near the Arctic Circle. The garden beds were filled with huge poppies and dahlias. Turnips, parsnips, cabbage, onions, potatoes, soybeans, raspberries, and strawberries were all flourishing in latitude 63° N. Delphiniums 5 feet high were growing wild through the bush nearby. The steamer reached Dawson City about 10 P.M. on August 5.

Dawson City and the Klondike Gold-field. Dawson City is built on a flat about 20 feet above the Yukon River, at a height of 1,200 feet above sea-level. Just to the east, immediately behind the town, rises Moosehide Mountain, which is 3,270 feet high. The most prominent feature in the landscape is the hollow made in the side of Moosehide, where a great landslide occurred in the past; and the large Catholic Hospital is built at the foot of the slide. The area upon which the town is built rises slightly to the east to the base of a very well-marked bench, with a flat surface at 1,600 feet. The wide "braided valley" of the Klondike

River enters the Yukon just to the south of the town, and is about one quarter of a mile wide at the junction (Fig. 4). There is a long promontory of gravel to the south of the junction, and below this are a few houses which remain from the once much larger settlement of Klondike City. The low bridge across the Klondike River has been washed away.

The Yukon River is half a mile wide at Dawson, where the stream is narrower than usual. A high bluff rises over 1,000 feet directly above the water on the west side of the river, and a steel cable extends from its slopes to an 80-foot tower in Dawson. A ferry boat swings from this cable, and is carried to and fro across the river by the action of the swift current. There are only a few small houses on the west side of the Yukon. About a mile above the gravel terraces at the junction of the two rivers, the Klondike Valley broadens considerably to a flat plain a mile wide. This extends east as far as the airport (seven miles), where Hunker Creek joins the Klondike River (Fig. 3). Above Hunker Creek the Klondike plain becomes even broader, being two miles wide in places.

The most famous valley in the world for alluvial gold lies just to the south of Dawson, and is called Bonanza Creek. Its main tributary, about nine miles south of Dawson, is Eldorado Creek, which rises in the granite mass of the Dome (4,250 feet), but about six miles to the west of the highest point. Hunker Creek and a few valleys south of the Dome were also found to contain much alluvial gold. No veins, from which this alluvial was derived, have been found on the Dome, so that probably the original gold veins have been removed by erosion.

The boom time was around 1900, when there were about 30,000 people in the Klondike diggings. Today there are practically no diggers, and the gold-mining consists exclusively in dredging by means of a dozen of the largest dredges known. These are slowly working over the acres of tailings and alluvial, which remain in the valleys as the result of the labours of previous miners. During the war only three dredges are in use, each employing about seventy men in the dredging or in connection with repairs, transport, and the camps. Some of the men live in Dawson, others in the local camps (each of about six houses) scattered near where the gold is being won.

Dawson City is the capital of the Yukon Territory, and is a more imposing settlement than any of the others described in this survey. But one of its most interesting features is that it represents a town whose best days have long passed away; and though it is by no means stagnant now, yet the streets of empty shops and the numerous abandoned cabins recall the more flourishing days of the Klondike boom. It was of special interest to find out how the abandoned portions were distributed with regard to the still thriving centre of the town.

In the original town-plan the main street (King Street) led to the east from the wharf to the 1,600-foot bench at the back of the town (Fig. 4). Three other parallel streets were laid out to the south, at about 500-foot intervals. Bordering this "grid" are two streets (Church and York) at half this interval. The cross streets (parallel to the Yukon River) are at 150-foot intervals, and are labelled First, Second, etc., as one proceeds inland. This "street grid" was carried far to the east, so that it climbed up the 400-foot scarp, and extended some distance

above the 1,600-foot bench to the cemeteries. But there were never any large houses on the high bench, and now hardly any cabins are occupied amid the thick second growth, which covers the bench and the steep scarp below.

Today the centre of the town, as always, is close to the wharf at the lower end of King Street. There are several warehouses along the river here, as well as a large and imposing bank. The main hotel is also on First Street close to the river, and a large department store (partly one storey) is at the corner of King Street. The second hotel is on King Street opposite the old post office. There are four abandoned hotels in Second and Third Street, which date back to the palmy days of forty years ago. Many of the shops in King Street are built of brick, which is most unusual in the far north-west. There are four other stores on King Street, and one or two in other streets, but most of the shops in Second and Third seem to be empty or used mainly for storage. The mining companies have a nice building on King, and here are some other shops and a dance hall, with a cinema at the west end.

The most imposing building is that which accommodates the administration, and the post office. This is placed nearly a mile away from the wharf in a nice little park in the south of the town. There is a large area near here occupied by the offices of the Mounted Police; but the huge three-storey building is abandoned, and the officers use a small frame house nearby. In this section of the town, near a long slough or pond, are two fine churches built by the Anglicans and Presbyterians, but the latter is no longer in use. The Catholic Church is on King Street. The public school is on Queen Street, and is a large two-storey frame building with an iron roof. There are four teachers and about 130 pupils. Near by are a Masonic Hall, theatre hall, rink, and government liquor store.

The private houses are shown in Fig. 3, either as small circles for the pretty little bungalow houses, or by dots for the less attractive shacks. There is a tendency for the better houses to collect on the slope east of the town, and behind the park. The shacks are mostly in the rather scrubby lowland in the north of the town, or in similar rather swampy land in the south near the two churches. A great deal of the street "grid" seems to be overgrown by willow scrub as indicated on the sketch map, and I was not able to ascertain if this had once contained cabins. It is of course the practice in these pioneer areas to remove cabins and houses bodily to other sites as required, since all lumber and labour is expensive in the north. Along the river road, which runs up Klondike River to Bonanza and the airport, are a number of small houses and shacks where flourishing vegetable gardens were a notable feature in the town. One or two of the private flower gardens in the better area behind the park were full of a multitude of flowers. Some of the delphiniums were 10 feet high, and I have never seen finer poppies or better turf anywhere.

Frozen ground is much in evidence at Dawson, and the current opinion is that the town "is built over a glacier." This is based on the fact that several feet of clear ice may be met with a foot or so below the surface in places. But such lenses of clear ice are common in high latitudes, and do not mean that an ancient *continuous* glacier has been covered with soil at Dawson or elsewhere.

After cultivation the soil often sinks over such melted ice, and a small pond in the park was a level lawn a dozen years ago. All attempts to level this by adding soil, moss, sawdust, etc., seem to be unavailing.

One of the "shows" of Dawson is the series of glasshouses where great numbers of tomatoes are grown and ripened. The crop is sent by boat to the large population at Whitehorse. Celery was nearly 3 feet high at the time of my visit. A large dairy herd is grazed on many acres of grass near the airport, and milk is regularly delivered from this herd. Much brome grass has been planted in the native meadows; but the spread of motor tractors has done away with many of the horses, and so led to a decrease in farming. Wheat has been grown, ripened, and ground into flour, at Swede Creek a few miles south of Dawson.

I was able to make a rapid traverse of Bonanza and Eldorado Creeks, a journey of about fifteen miles. Here where thousands of miners were living around 1900 there is now only a cluster of about six houses at Grand Forks. Owing to the second growth, and to the removal of timbers, etc., there is hardly a vestige today of the teeming population which once occupied these valleys. Dawson City with its widespread "grid," its shopping centre, and segregation of the better residences falls into the "adolescent" class of city evolution.

2. Whitehorse to Peace River; The Alaska Highway

I returned from Dawson City to Whitehorse by plane via Mayo. We left Dawson City by car in which we drove a dozen miles to the east to the airport in the flat floor of Hunker Creek. We passed the small settlement of Bear Creek, where there are about a dozen houses, which was once the scene of a flourishing alluvial gold-field. Near the airport Achille Fournier has a hundred-acre farm. We left the airport at 6.15 P.M. and reached Mayo (about a hundred miles away) in fifty minutes. Below the plane was the undulating plateau of this part of Yukon, in which the Hunker, McQuesten, and Stewart Rivers have cut rather deep flat-floored valleys (Fig. 3).

The flight from Mayo to Whitehorse was much the most scenic of all. We took off at 7.35 P.M. and traversed the two hundred miles by 8.55 P.M. Thus the return journey from Dawson City took about three and a half hours, instead of six days as it would have done on the steamer! Ten minutes after leaving Mayo we were flying south over Ethel Lake, an expanse of water running about twenty miles in an east-west direction (Fig. 3). Then we crossed the McArthur Mountains, whose summits rose to 7,000 feet. Along the rounded ridges were numerous large patches of snow. Ten minutes later fine "armchair valleys" (or cirques) appeared on the slopes of the Macmillan Range. The Pelly River wound in wide meanders on the flat floor of its valley. We flew just to the east of Lake Tatlmain, and crossed over a residual plateau, with steep valleys notching its margin, just before we reached Lewes River. Another ten minutes brought us to Lake Laberge, whose thirty-five miles was traversed in about a quarter of an hour. We reached Whitehorse at 8.55 P.M. on August 8.

I was allowed to traverse the Alaska Highway, which is closed to civilians,

in a military autobus. Some geographical notes on this famous highway, so early in its history, may be of interest. The vehicle in use was a large Greyhound bus to hold about thirty passengers, though only fourteen made the journey with me. There were two drivers, who drove for about three hours at a time, day and night. We started from Whitehorse at 8.30 P.M. on August 9; and proceeded north for a few miles to join the highway, which runs along the top of the scarp shown in Fig. 1. Here we turned south on our long journey of 918 miles to Dawson Creek, the present "end-of-rail" (Fig. 5).

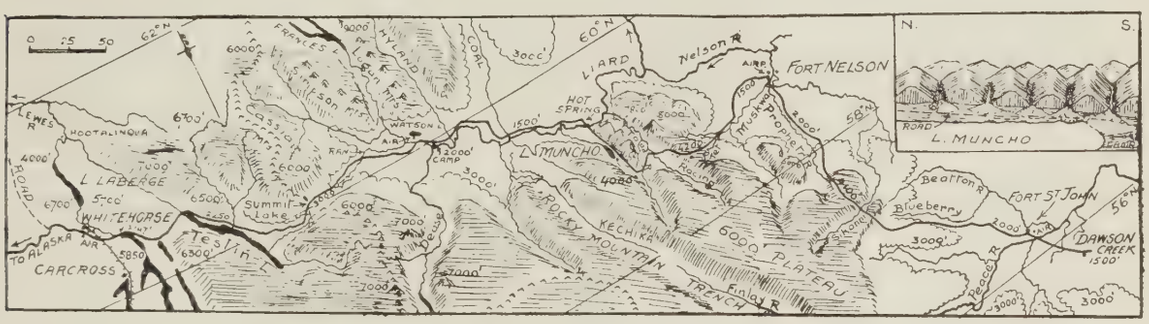


Fig. 5. Chief topographic features on the Alaska Highway from Whitehorse to Dawson Creek. The contours, etc., are only approximate.

For several miles we passed areas covered with stores and machinery gathered during the building of the road, and at ten miles reached a military post, where we were halted and all the passengers and their papers were examined. The 4-inch pipe, which carried the oil from Norman Wells, lay on the ground alongside the road until we reached the north end of Teslin Lake (2,250 feet). For a time we coasted a small lake (Marsh Lake, 2,147 feet); but after eighty miles we stopped for a midnight meal at one of the large maintenance camps near Teslin Lake. Here coffee and bread and butter were served free to the drivers and passengers. It was now quite dark, and I was unable to take notes until about 4.30 A.M,. when we were near the Continental Divide at a height of over 3,000 feet. On each side was undulating plateau-like country at about 5,500 feet level. To the north are the Cassiar Mountains (Fig. 5).

The road ascended Swift Creek by easy grades from about 2,500 feet to the Divide near Summit Lake, where the Rancheria River (RAN. in Fig. 5) rises; and then followed down this river for some fifty miles. There was a maintenance camp with fourteen huts near this highest point on the Divide. About a mile to the south were cirques in a rather high peak which rose to about 6,100 feet. Most of the rounded granite bosses rose well above the tree line. Near the lower Rancheria Bridge was another maintenance camp twenty miles east of the other. From here we climbed up to a plateau about 3,000 feet which occupied the angle between the Rancheria and the main Liard River. This plateau was covered with thin spruce (7 inches in diameter) and poplar. We dropped down to the large Liard River, which is crossed by a steel truss bridge some 273 miles from Whitehorse. Here the spruce was of much larger diameter, some trees being 18 inches across. A fair amount of lodgepole pine was present here, but only a few per cent in comparison with the spruce. The main halt for breakfast was at the

maintenance camp at Watson Lake, about eight miles south-east of the airport (where I had halted on my flight to Whitehorse). Here a large and appetizing breakfast was served at a fixed cost of 28 cents.

Hereabouts the Alaska Highway crosses the famous "Rocky Mountain Trench," which is another example of those N.W.-S.E. depressions discussed in the first section. It is a shallow fold-depression which extends from Idaho to the Kechika Valley in this district (Fig. 5). It may extend north by the Frances, Pelly, and Yukon Rivers as far as Alaska.

Twelve miles beyond Lower Watson Lake is a fine bridge over the Hyland River. On the west side of the river the Hudson's Bay Company has erected a fine pair of buildings with the usual red roofs. We traversed loamy country with spruce of about 11 inches in diameter. Here white spruce is more abundant, but in the higher plateau areas to the east H. M. Raup has noted the greater importance of black spruce.[2] Pine and poplar were relatively more abundant on the lower flats. Much the same type of country was seen all the way to Coal River, where the road runs close to the Whirlpool Canyon at the junction with the Liard River.

The highway now follows the north bank of the Liard River for thirty miles, often running below steep slopes of 1,000 feet. Just near the big bridge over the Liard is the famous Hot Spring (Fig. 5), which lies about half a mile north of the road at 422 miles from Whitehorse. We halted here for an hour, and had a pleasant bathe in water around 150°F., smelling strongly of sulphur. Several enclosed bathing sheds have been erected; and it is stated that special plants grow close to the springs owing to the mild winter temperatures.

Some twenty miles from the Hot Spring the scenery along the highway becomes quite mountainous. The road rises considerably as it proceeds south near Trout River. In places it traverses a deep valley bounded by slopes some 2,000 feet high. Gray walls of granite devoid of trees seem to bar our passage as we approach Lake Muncho (2,700 feet). There is a cluster of a dozen houses at the north end of this lovely alpine lake. From the range to the east open a number of parallel valleys, which are sketched in the inset in Fig. 5. Each shows evidence of past glacial action, and is marked by a large "fan delta." The road is now jammed between the lake and the steep slopes; and so rises and dips over these almost coalescing fans. About 3 P.M. we reached the large camp at the southern end of Lake Muncho, and here halted for lunch. Our journey to Dawson Creek was half over.

To the north-east of Muncho Lake appeared a veritable Matterhorn, a peak rising to 8,000 feet; while a row of pyramid mountains fringed the road on the north. As we approached Toad River we seemed to be heading right into these high mountains; and in places, signs warned that rock-falls threatened the road. We traversed a veritable canyon on our approach to Racing River, and some of the cliff faces show extremely interesting contortions in the strata. The road reaches its highest elevation (4,200 feet) hereabouts. There are some fine cirques in the mountain slopes to the north-east. Near the bend of the Tetsa

[2] *Geographical Review*, Jan., 1945.

River is a large military camp, and to the south are curious pinnacles of soft rock of the "hoodoo" type.

The mountains to the east were crowned with projecting knobs of curious shape, resembling a box, a football, and the Duke of Wellington's profile. Some fifty miles west of Fort Nelson we climbed up to the top of a ridge; and then dropped fairly steadily to Steamboat Creek. Near Kledo Creek is a saw-mill, and both the spruce and black poplar timber was of much larger size than heretofore. We reached the very large road maintenance camp at Fort Nelson about 8.30 P.M. The bus proceeded on during the night, and soon climbed to the highest lengthy portion of the road, where it attains a height of 4,100 feet. Here, as the map in Fig. 5 shows, it is crossing a portion of the main plateau of the Rocky Mountains. In this area the plateau is much dissected, but lies at a level of 5,000 or 6,000 feet, with rounded bosses rising somewhat higher.

Early next morning we dropped gradually down from 4,000 feet to the plains around the Peace River near Fort St. John. About five miles from the latter town we saw the first farms on the northern edge of the Peace River block. We reached the first hotel on the Alaska Highway, about 7.00 A.M. on August 11. After spending some hours on a survey of the little town, and visiting Mr. Hadland's demonstration farm, I drove on a distance of fifty miles to Dawson Creek. We crossed the lengthy and expensive Peace River Bridge a few miles south of Fort St. John. Here the Peace River flows in a narrow valley eroded in the floor of a wide flat, about a mile and a half across. This flat is very fertile soil, and is about 400 feet below the general level (around 2,500 feet) of the prairie; and all of it seems to be converted into flourishing farms. Between the river and Dawson Creek there was not much farming at first visible from the road. About half way we passed a few shacks and some humble farms, and then the road dropped into the Kiskatinaw Valley, where it descends below the 2,000-foot level for almost the first time on the whole journey. Near Sweetwater were some fine fields of grain, which were being reaped as we passed. More expanses of poor poplar scrub intervened, but about seven miles from Dawson Creek we entered the completely cleared lands which surround this important section of the Peace River block. I reached the southern terminus of the Alaskan Highway at noon on August 11.

The Settlements of Fort Nelson, Fort St. John, and Dawson Creek. Fort Nelson was founded on a tributary of the Liard of the same name as long ago as 1800. The Indians destroyed the post in 1825, and it was re-established in 1865, so that it has had a long and varied history. The general position can be seen in Fig. 5, and today there are three separate settlements in the district. The original fur-trading post is on the east bank of the river, near its junction with the Muskwa. Three miles to the west is the large airport, and three miles still further west is the large maintenance camp associated with the building of the highway. This separation of the functions of a region is rather characteristic of these new settlements, as we have seen at Whitehorse and Norman Wells.

From the central airport, where the writer landed late on August 2, it was quite a long and varied walk to the old settlement. The airport is on a flattish,

thickly forested, plain, into which the Muskwa and Fort Nelson Rivers have cut deep wide valleys several hundred feet below the general level. The road zigzags down to the river passing a small sawmill, operating on the 20-30-inch spruces and poplars. It was necessary to wait on a bank of boulders in the stream for some time, until some resident on the far bank would come over in a boat and transport us across the wide river. As Fig. 6 shows, the old settlement is extended along the top of a 40-foot cut-bank for a distance of a mile. There is not much level land, for the slopes rise rather rapidly to the plateau-level, some 400 or 500 feet above the river.

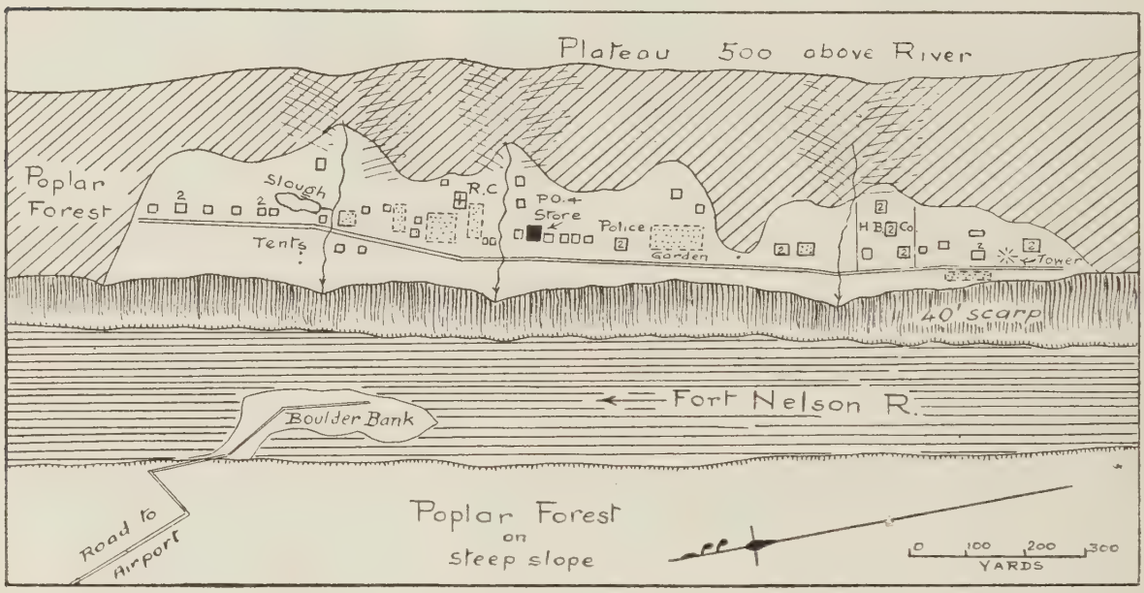


Fig. 6. Sketch survey of right bank of river at Fort Nelson, looking to east. Dotted areas are gardens; *2, 2,* means two-storey.

A wind-motor tower is at the south end, with several two-storey houses nearby. Then comes the Hudson's Bay land, with a store, residence, and several sheds. The Mounted Police have an office here, and there is an independent store, with a café and pool-room, about the centre of the settlement. The rough lane crosses a muddy creek, and then we reach the Catholic lands with several patches of garden. The little church is a plain frame building with a porch, set back some distance from the road, and is distinguished by a huge black poplar in the foreground. At the north end of the post were nine shacks inhabited by several white trappers and a number of Indians. Fur prices have improved greatly in 1944; and I was informed that a marten fur would only bring $15.00 about eight years ago, but is now worth $100, while beaver fur has risen from $10.00 to $34.00. Potatoes, cabbages, turnips, etc., do splendidly, but maize cobs and tomatoes do not ripen out of doors. Floods of unusual severity damaged the gardens in the summer of 1943. About a dozen whites live at this settlement, which is of the "sub-infantile" class. It was not permissible to make a survey of the airport, where there were said to be 750 men employed, partly in constructing the airfields.

During my visit to Fort St. John I was greatly helped by Mr. Hadland of the local "Illustration Farm." Much of the following information is derived from him, as also are some of the data on the sketch map. The first Fort St. John was built in 1805, some distance south of the present settlement, near Pine River. It was moved in 1873, in 1885, and again to the present site in 1925. In 1928 there were three government offices in the young town, as well as the new Hudson's Bay post. The first log hotel was just being built, but most of the private residents lived in tents. The Anglican Church was erected in 1930, and the hospital and flour mill about 1933. The development of the airway to Alaska, with a

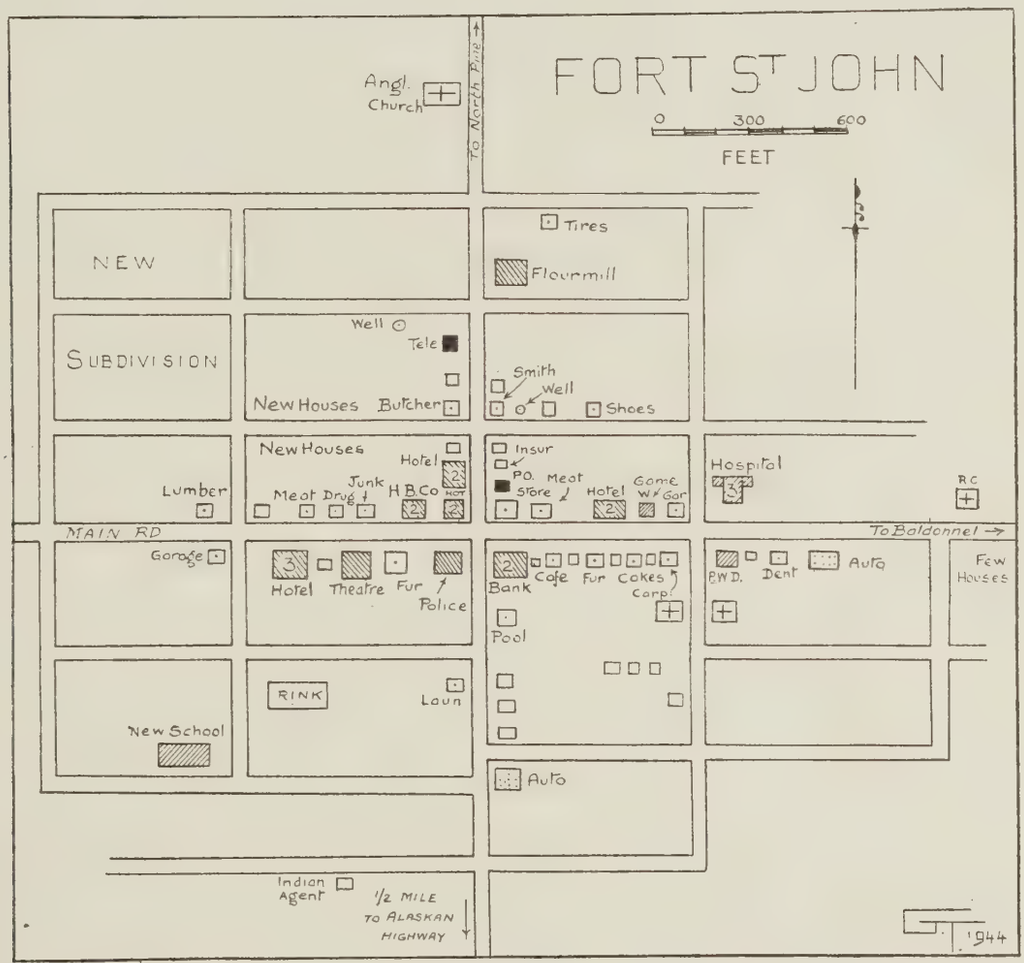


Fig. 7. Sketch survey of Fort St. John. Main buildings are black or ruled; shops have a single dot, churches a cross.

very important airport about four miles to the east of St. John, together with the construction of the Alaska Highway, which runs diagonally across the south-west corner of the town, have all greatly increased the growth of the town in the last two or three years. This is clearly indicated by the sketch survey presented in Fig. 7.

The town plan is the conventional grid, based on the original township survey. In fact at the cross roads four townships meet, their boundaries being the two main roads shown in the plan. The country is almost level, and there seems no obvious reason for choosing this particular crossing of boundaries as the site of a town. The chief shops are to be found on the west-east road between the bank and the main hotel. There are two other hotels, a theatre, and a police post

in the shopping centre. Three butchers, two fur dealers, several cafés, and a drug store about complete the list. Further away are the large hospital, the new school, a rink, two auto camps, two garages, and a flour mill. As usual the churches—of which there are four—are on the borders of the little town. I believe that a number of new houses have been added in the summer of 1944 after I visited the town. These have grown up chiefly in the north-west. With its well-developed street-grid, and the presence of a factory or two, this settlement may be placed in the "juvenile" class.

There are a few farms as much as forty miles north of Fort St. John. The selection of a farm-site depends on the character of the soil, which varies a good deal more hereabouts than south near Peace River. Near Baldonnell much seems to be gray soil covered by poplar or willow forest. Mr. Hadland had various types of grain on his farm, the wheat being of the spring wheat type, which is sown about the third week in April. The harvest occurs between August 10 and September 10, depending largely on whether the soil is warmed early or late in the spring. Hogs are an important product in parts of the district. Potatoes are planted in the middle of May, and some early potatoes may be dug early in August. Oats, alfalfa, and flax are other crops grown in the St. John region. It is difficult to obtain an adequate water supply, and large reservoirs are scooped out of clay soil, which collect water after the winter if there has been a good snowfall. Otherwise water is apt to run short for stock and house. Two good wells have been sunk recently in the town itself. In 1941 there were 170 residents in Fort St. John, but this figure has much increased lately.

The last town considered in this survey of settlement in 1944 is Dawson Creek, where the Alaska Highway reaches the connected Dominion railways. The little farming centre (as is the case at Whitehorse) has been surrounded by the temporary barracks and warehouses of the American Army, for here material for the highway was transferred from rail to road. I was not able to make any survey of the new sections, which however did not impinge on the older settlement to the extent that they did in Whitehorse. The west-east streets are numbered from the north, so that the road next to the railway is First Street (Fig. 8). This has the honour of being the first section of the great highway, and a post in the middle of the road at its east end is labelled Zero, and from here distances are measured to Fairbanks, Alaska.

In 1917 the railway was extended to Grande Prairie (about eighty miles to the south-east) and reached Dawson Creek in 1930. Farming in the Peace River block of British Columbia started about 1917, and by 1921 was scattered northwards as far as Fort St. John. The town of Dawson Creek is therefore about twenty years old, and in 1941 the population was 518.

The most prominent features of the town are the five wheat elevators on the highway at the north-west corner. These show that we are in the midst of a thriving wheat-producing area, and have left the real pioneer lands behind us to the north. The street plan is the normal grid, with the streets oriented with regard to the true North. The functional plan resembles that of Whitehorse much more than that of Fort St. John. The town has grown entirely to the

south of the railway, so that the main streets resemble a T rather than a +. First Street is adjacent to the railway, and contains warehouses and garages, but no shops. These are found chiefly on Second Street, though a number are also on Main (or Tenth) Street at right angles to the former. It is unusual in a street-grid to name the cross-streets "Ninth," "Eleventh," and "Twelfth," as has been done in Dawson Creek.

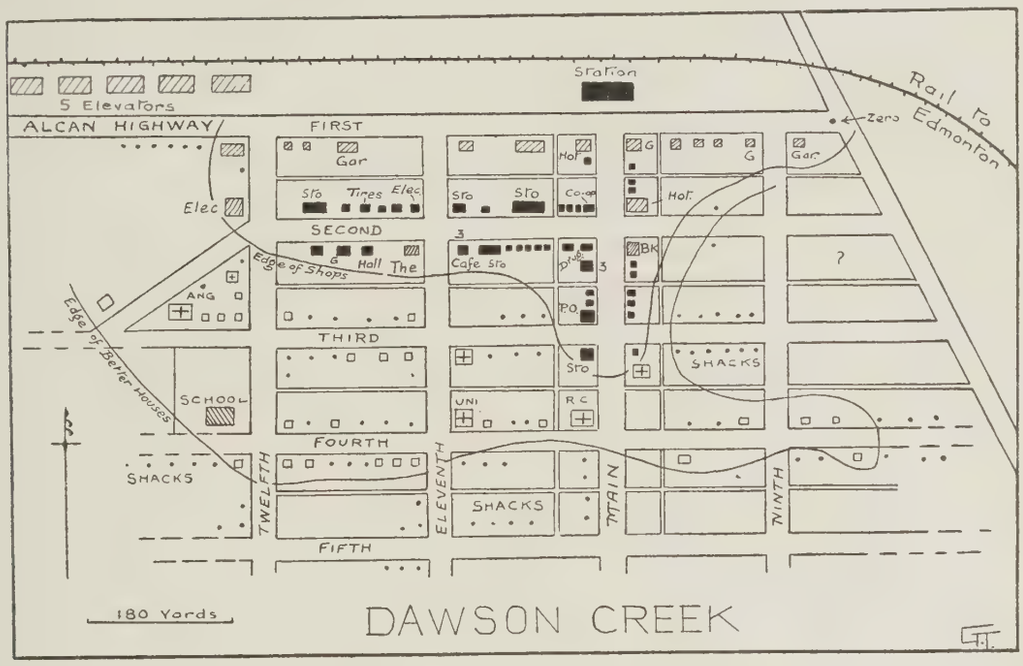


Fig. 8. A functional plan of Dawson Creek—where the Alaska Highway reaches the railway. Shops are black; main buildings are ruled; shacks are shown by dots.

The shopping area forms a sort of "T," as is usual in an asymmetric plan. Surrounding this is a zone of better-class houses, and here are the five churches and the large school (Fig. 8). Then on the margins are a great number of small houses and shacks, some of which no doubt are only temporary, and have arisen in the last year or so, since construction began on the highway. The two hotels are in the blocks next to the station in Main Street, as also are the bank and post office. There are three department stores, five restaurants, and six other general stores. Drugs, drapery, shoes, and beauty parlours are each represented by one or two shops. As in the case of St. John and other farm centres, there are many shops compared with the residents in the town, for their customers come mainly from the numerous farms in the district.

3. Some General Conclusions

The geographer believes that the natural vegetation is the best indicator of the possibilities of a new region. It is therefore of great importance to remember that the type of vegetation is uniform in character from latitude 57° at McMurray to latitude 68° at Aklavik. What has been done at the southern end in the way of agriculture can be done in the Far North. In general, conditions resemble those of the tip of Gaspé or the west of Newfoundland, and bear no real resemblance

to the environment in the far north of Quebec Province or Labrador; though the latter are in the same (or lower) latitudes as the region under consideration.

Of the score of settlements examined in some detail the largest has only about seven hundred inhabitants. In all cases it is easy to see how the population responds to the natural environment. A complete sequence of "small-town" development in a pioneer region can be based on this survey, though the writer has only given general results in this preliminary paper. Turning to the native population, the training of the Indians and Eskimos should have more stress laid on hygiene and on the adequate exploitation of their environment. The government realizes this, but not all the missions, so far as the writer's rapid survey indicated.

As regards scientific surveys, the extension of soil surveys by the governments is to be highly commended. This is the key to future profitable settlement. We must find out which are the *best* districts, and direct all Canadian pioneers to such places. The writer has had twenty years' experience in preliminary survey work of this sort in "Empty Australia," and is firm in the belief that "Empty Canada" has far better prospects. There is no first-class land left perhaps, but there is an unlimited area which will grow potatoes and meadow hay, which some day will be of great value. The more rugged country of the Yukon is not so promising as the Mackenzie Basin. An enterprising government would send trained geographers, climatologists, and related scientists to study what has been done in exactly similar environments in Sweden, Finland, northern Russia, and northern Siberia. They are several decades ahead of Canada (owing to their greater population and resources), and we can benefit from their mistakes as well as from their successes. The similar environments are charted in Fig. 9.

The place of mining and of tourism deserve some mention. Mines, in a pioneer region, perform three functions as regards settlement. The winning of valuable metals, coal, or oil, from the earth obviously brings a good deal of ready money into the district. It also helps materially to make the particular region known, as for instance the Eldorado Radium Mine on Great Bear Lake. But the chief function, perhaps, is to provide a small centre which is a ready market for such crops as the country may be able to produce. It is not realized by many readers that a country like pioneer Canada can produce unlimited tons of potatoes, whose value is considerable *on the farm*, but the cost of transport to large centres of population is quite prohibitive at present. We must in a sense wait for the population to grow towards the Mackenzie Basin before many of its potential crops can be properly utilized.

The splendid road called the Alaska Highway brings up the question of the possibility of important tourist traffic. I do not see clearly what is to justify keeping this in running order after the military necessity has passed away. The scanty population was and can be served by small river boats up the Liard, Dease, and other tributaries. The new airways will be kept going doubtless, and will serve for the carriage of passengers and small merchandise. The roads may long have deteriorated before the local place-to-place traffic makes much use of them. Yet it might be possible to attract a large tourist traffic if there were a

regular airline from Aklavik to Dawson City. Thus a "tourist triangle," including a voyage down the Mackenzie, and the above flight, and then a voyage up the scenic Yukon, and a long motor-bus ride south-east along the Alaska Highway, could be arranged. Some day this will be done.

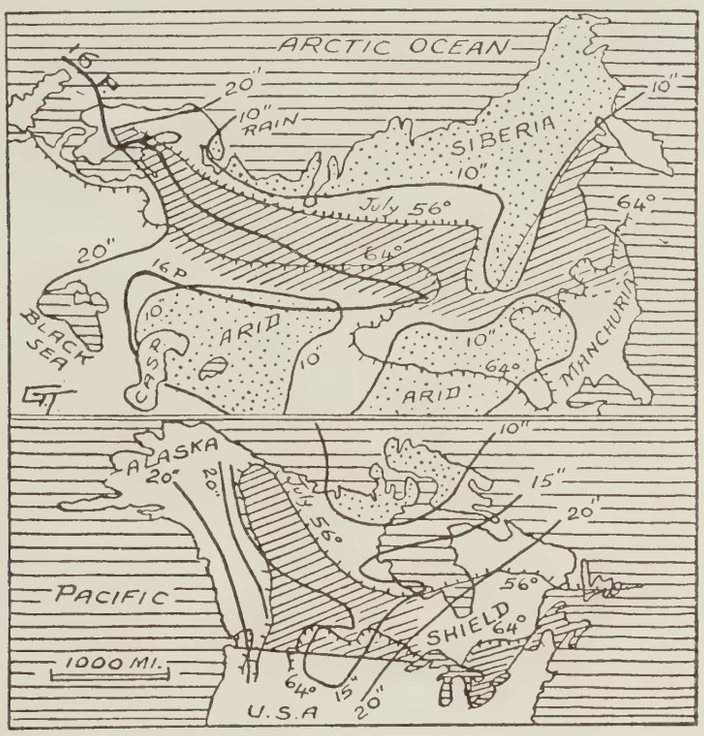


Fig. 9. The environments of Canada and the U.S.S.R. are much the same—as these climatic maps show. The undeveloped parts of Canada are ruled like similar areas in the U.S.S.R. Note limit of sixteen people to square mile in the U.S.S.R. (shown by 16 P.).

The writer is grateful to those concerned for the opportunity to study the pioneer belt in this interesting transition stage of development. He wishes that he could convince the Dominion authorities of the value of a geographic training for a number of their "cadets." This is done on a large scale in England to help officers going to administer out-of-the-way portions of the Empire. In Sydney University I had six cadets a year in my Department for this purpose. It will be seen from these surveys that some settlements have not grown perceptibly in the last forty years. This condition is sure to change greatly in the next decade, owing to the spread of flying, of the search for minerals, and of the realization of the position of Arctic Canada on the air-routes to the Far East.

Griffith Taylor

The University of Toronto.

THE CANADIAN JOURNAL OF ECONOMICS AND POLITICAL SCIENCE

August, 1945

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THE NORTHWEST TERRITORIES



ADMINISTRATION, RESOURCES AND DEVELOPMENT



Above—*Fort Smith, showing the Slave River and rapids in background.*
Outside front cover—*Upstream view of the site of hydro-electric power development on the Snare River, looking northeast.*
Outside back cover—*The settlement of Arctic Bay, northern Baffin Island. King George V Mountain in background.*
Below—*Town of Yellowknife. New townsite area in foreground and original settlement in background.*



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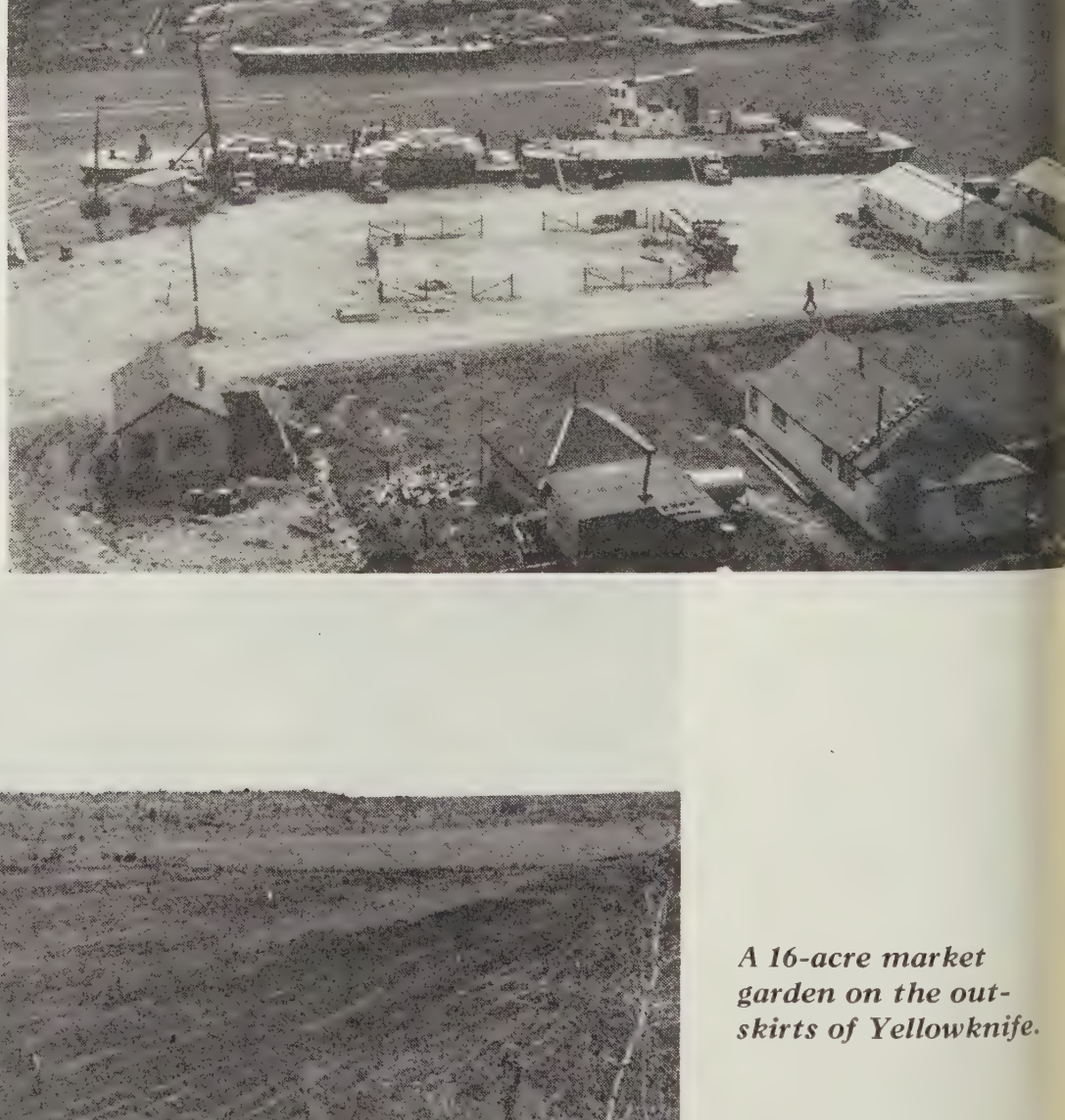
The Northwest Territories

Administration — Resources — Development

Issued by the
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LANDS AND DEVELOPMENT SERVICES BRANCH
OTTAWA
1948



General view of Negus Gold Mines, Limited property, showing headframe and mill.



Unloading freight from barges at Yellowknife. Oil storage on Jolliffe Island in background.

A 16-acre market garden on the outskirts of Yellowknife.

All Photos by
National Film Board

FOREWORD

This publication, a summary of general information on the Northwest Territories, has been compiled in the Northwest Territories and Yukon Services at Ottawa. Acknowledgment is made of the co-operation of the various Canadian Government services in supplying information from their respective fields. More detailed information may be obtained by consulting the various Government reports and other references listed in and at the end of the text.

Additional copies of this booklet may be obtained on application to the Northwest Territories and Yukon Services, Lands and Development Services Branch, Department of Mines and Resources, Ottawa, Canada.

R. A. GIBSON,
Director,
Lands and Development Services Branch

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THE NORTHWEST TERRITORIES

Location—Area—Population

THE NORTHWEST TERRITORIES contain the mainland portion of Canada lying north of the 60th parallel of latitude between Hudson Bay on the east and Yukon Territory on the west, together with the islands lying between the mainland of Canada and the North Pole, including those in Hudson Bay, James Bay, and Hudson Strait. The total area of the Northwest Territories is 1,304,903 square miles, or more than one-third of the total area of the Dominion.

For purposes of organization and administration, the Northwest Territories are divided into three districts: Mackenzie, Keewatin, and Franklin. Mackenzie District, 527,490 square miles in area, includes that part of the mainland lying between the 102nd meridian of longitude and Yukon Territory. Keewatin District, 228,160 square miles in extent, includes that part of the mainland, with the exception of Boothia and Melville Peninsulas, lying between Mackenzie District and Hudson Bay, together with all islands in Hudson and James Bays. Franklin District, with an area of 549,253 square miles, includes Boothia and Melville Peninsulas and the islands in Hudson Strait and in the Arctic Archipelago, except those adjacent to the coast of Yukon Territory.

According to the decennial census of 1941, the population of the Territories was 12,028, including 2,284 whites, 4,334 Indians, 5,404 Eskimos, and 6 others. An estimate of the population made in September, 1947, placed the total at 15,201, including 5,214 whites, 4,334 Indians, 5,651 Eskimos, and 2 others (Chinese).

GOVERNMENT AND ADMINISTRATION

The Northwest Territories Act (Chapter 142 R.S.C. 1927) provides for a Territorial Government composed of a Commissioner of the Northwest Territories, a Deputy Commissioner, and five councillors appointed by the Governor in Council. The Commissioner in Council has power to make ordinances for the government of the Territories, under instructions from the Governor in Council or the Minister of Mines and Resources, respecting direct taxation within the Territories in order to raise revenues, etc., and in respect to the establishment and tenure of territorial offices; the appointment and payment of officers, maintenance of prisons, municipal institutions, licences, solemnization of marriages, property and civil rights, administration of justice; and generally to all matters of a local or private nature in the Territories. The seat of government is at Ottawa.

The Northwest Territories Council is now composed as follows:

Commissioner, Hugh L. Keenleyside, Ottawa; *Deputy Commissioner*, Roy A. Gibson, Ottawa; *Members of Council:* Stuart T. Wood, Ottawa; Donald M. MacKay, Ottawa; John G. McNiven, Yellowknife; Louis de la C. Audette, Ottawa; Harold B. Godwin, Ottawa; Secretary, James G. Wright, Ottawa.

Council meetings are held regularly. The Council functions not only as a legislative body, but in an advisory capacity to the Minister of Mines and Resources on matters pertaining to the administration of the Northwest Territories. Careful consideration is given to matters affecting the well-being of the resident population, white and native. Appreciation of the fact that natives must, by reason of character, training, and environment, depend almost entirely on hunting and trapping for a livelihood is reflected in the provisions of the game regulations and in the large areas set aside as game sanctuaries and native game preserves.

The administration of the various Acts, Ordinances, and Regulations pertaining to the Northwest Territories is supervised by the Director of the Lands and Development Services Branch, Department of Mines and Resources, who is also Deputy Commissioner of the Northwest Territories. His office is located at 150 Wellington Street, Ottawa. The administrative office for Mackenzie District is at Fort Smith. The main office for the transaction of mining business is at Yellowknife.

The Northwest Territories are not represented in the Parliament of Canada at present. However, in 1947, the electoral district of Yukon was enlarged by the addition of that part of Mackenzie District, Northwest Territories, lying west of the 109th meridian of longitude. The new electoral district, known as Yukon-Mackenzie River, will be represented in Parliament following the next Federal election.

The Yellowknife Administrative District was established on October 1, 1939, under the provisions of the Local Administrative District Ordinance. The affairs of the District are managed by a Local Trustee Board of nine members. The chairman and three members of the Board are appointed for a period of one year by the Commissioner of the Northwest Territories. The remaining five members are elected annually by residents of the District. The Board functions in a manner similar to that of a town council, with authority to assess real property and raise taxes for municipal purposes, including maintenance of schools, roads, sidewalks, and water, sewer, and sanitation services.

The enforcement of law and order is the responsibility of the Royal Canadian Mounted Police, and detachments are established at strategic points throughout the Territories. By means of extensive patrols, both in winter and summer, a reasonably close check is kept on a very large region by a comparatively small body of men. Detachments of Royal Canadian Mounted Police in the Territories are stationed at Aklavik, Arctic Red River, Cambridge Bay, Coppermine, Fort Good Hope, Fort Liard, Fort Norman, Fort Providence, Fort Resolution, Fort Simpson, Fort Smith, Norman Wells, Port Radium, Rae, Reliance, Yellowknife, Baker Lake, Chesterfield, Coral Harbour (Southampton I.), Dundas Harbour, Eskimo Point, Frobisher Bay, Lake Harbour, Pangnirtung, and Pond Inlet.

SOCIAL SERVICES

Medical and Hospital Services

THE WELFARE of the Indian, Eskimo, and indigent white and half-breed population of the Northwest Territories and of the Ungava region of Quebec is a responsibility of the Department of Mines and Resources. The medical care and hospitalization of Indians and Eskimos, however, are responsibilities of the Indian Health Services of the Department of National Health and Welfare.

Hospitals or nursing stations are operated at a number of settlements in the Northwest Territories and in Arctic Quebec. The greater number of these institutions are maintained by missions of the Church of England in Canada and the Roman Catholic Church; the others by the Department of National Health and Welfare and the mining industry. Hospitals operated by the Church of England missions are situated at Hay River (nursing station) and Aklavik, in Mackenzie District, and at Pangnirtung on Baffin Island, Franklin District. Roman Catholic missions operate hospitals at Fort Smith, Fort Resolution, Rae, Fort Simpson, and Aklavik in Mackenzie District, and at Chesterfield in Keewatin District. Nursing stations are

maintained by the Indian Health Services of the Department of National Health and Welfare at Fort Norman in Mackenzie District, and at Fort Chimo and Port Harrison in Arctic Quebec. Plans are under way for the establishment of similar services at Lake Harbour, Baffin Island, and at other Arctic settlements.

Small hospitals are maintained by the Consolidated Mining and Smelting Company of Canada Limited at Yellowknife; by Eldorado Mining and Refining (1944) Limited at Port Radium; and by Imperial Oil Limited at Norman Wells, in Mackenzie District. These hospitals are in charge of resident doctors retained by the companies. The construction of a new 40-bed hospital was completed in 1947 at the settlement of Yellowknife, to the cost of which the Dominion Government is contributing a substantial share. This institution, designed to serve the Yellowknife mining region, is expected to be available for use in 1948.

The mission hospitals have accommodation varying from 10 to 50 beds, possess surgical facilities and, in most cases, X-ray equipment, and are in charge of resident doctors and graduate nurses. The nursing stations at various settlements are in charge of qualified nurses. Industrial homes for the aged and infirm are operated in connection with the mission hospitals at Aklavik, Chesterfield, and Pangnirtung.

The Government of Canada has contributed substantially toward the construction costs of some of the mission hospitals, and also pays the missions a daily allowance at an established rate for each native, indigent white, or half-breed patient receiving treatment. All doctors, except those employed by the mining companies, are full-time employees of the Department of National Health and Welfare and serve as medical health officers for the district in which they are located. In the Mackenzie District, some of them also serve as Indian Agents. The doctor attached to the Con mine at Yellowknife serves part time as local medical health officer. The doctors located at the various settlements and posts in the Territories also serve the resident white population on a free basis.

In 1947, doctors attached to the Department of National Health and Welfare were located at Fort Smith, Fort Resolution, Fort Simpson, and Aklavik, in Mackenzie District; Chesterfield, Keewatin District; and Pangnirtung, Franklin District. Doctors maintained by the mining companies were located at Yellowknife, Port Radium, and Norman Wells.

The department of National Health and Welfare serves as a consulting agency in matters of public health, nutrition, and sanitation. All doctors in the Territories have recourse to the medical services of that Department in dealing with complicated cases or epidemics, and any information required immediately is usually transmitted by radio through Government or private commercial stations. At trading posts or settlements where medical services are not available, medical advice may be obtained in emergencies by radio from the medical officer for the district, or from the Department at Ottawa. Some medical supplies are furnished at Government expense to mission hospitals and to distributors in most of the remote settlements.

A qualified doctor accompanies the annual patrol of settlements and trading posts in the Canadian Eastern Arctic, and examines the natives at all ports of call. During the past two years, these examinations have included chest X-rays and a survey and treatment of Eskimo vision. A dentist also accompanies the patrol and serves those requiring treatment.

Dental services in Mackenzie District are provided by a dentist at Yellowknife and by dentists who visit the Territories from time to time.

Education

The education of the white, native, and half-breed children in Mackenzie District is carried on largely at residential and day schools operated under the supervision of the Dominion Government by missions of the Church of England in Canada and the Roman Catholic Church. Located in the principal settlements, these schools were constructed by, or with the assistance of, the Dominion Government, and their maintenance is assisted by annual grants from the same source. In addition, the Northwest Territories Administration furnishes liberal quantities of school supplies and equipment. Residential schools are operated by the Church of England mission at Aklavik, and by the Roman Catholic missions at Fort Resolution, Fort Providence, and Aklavik. Day schools are located at Port Brabant, Fort Norman, Port Radium, Fort Smith, and Fort Simpson.

A fine modern public and high school building has been completed at Yellowknife, and is designed to serve as a school of opportunity for school children residing at other settlements in the Territories. The Yellowknife school is the only one in the Territories maintained chiefly by local taxation and administered by a local school board. A non-denominational school at Fort Smith is maintained by fees and grants. In addition, a day school for Indian children is operated at Fort McPherson by the Indian Affairs Branch of the Department of Mines and Resources.

Public and high school students in remote areas of the Territories have access to correspondence study courses issued by the Alberta provincial educational authorities. The costs of providing these courses for residents of the Territories are borne by the Northwest Territories Administration.

Eskimo children in the Eastern Arctic are instructed at mission day schools. Because of their nomadic tendency, however, the Eskimos seldom remain very long at the settlements, and the periods available to the missions for teaching the children are therefore comparatively short. Eskimo children along the Western Arctic Coast and in the Mackenzie Delta attend the mission residential schools at Aklavik. The Eskimos of the Eastern Arctic have adopted a system of syllabic writing (geometric characters similar to a type of shorthand), which most of them can now read and write proficiently. The Administration has taken advantage of this fact to provide educational material in the Eskimo language giving advice on health and native economics for the benefit of both children and adults. It is planned to provide a measure of teaching service in connection with Government nursing stations which are to be established in Eskimo territory in the near future.

Educational matters come under the jurisdiction of the Northwest Territories Council, and on its recommendation, an Inspector of Schools was appointed in 1946. As a result of subsequent inspections made throughout Mackenzie District, the administration of education in the Territories is being re-organized and new facilities are being made available. Among the improvements planned are an extensive circuit for the regular distribution of educational films, special school radio programs broadcast to the classrooms, additional equipment and supplies, increased attention to methods of instruction, and new day schools in areas where facilities for educational instruction are not yet available.

SETTLEMENTS AND TRADING POSTS

SETTLEMENTS in the Northwest Territories range in size from surveyed townsites to small groups of buildings around trading posts or medical centres. The largest settlements are situated in Mackenzie District, and include Yellowknife, centre of the gold-mining industry; Fort Smith, administrative headquarters of the district; Aklavik, metropolis of the Mackenzie delta region, and Port Radium (Eldorado mine) on Great Bear Lake. In settlements other than Yellowknife and Port Radium, the white population is composed principally of government officers, transportation company officials, missionaries, traders, and others engaged in business. In the Eastern Arctic, the white population is largely transitory. It is formed of Government officers, missionaries, and traders, most of whom usually spend terms of five years or less at their posts before being transferred to other locations.

The townsite of Yellowknife, situated on Yellowknife Bay on the north shore of Great Slave Lake, has shown remarkable development in the last few years. Founded in 1935 following important gold discoveries in the vicinity, it is now a thriving community with a permanent population of about 3,500, which increases during the summer months. In 1945 and 1946, extensions to the townsite were made necessary by the increased demand for business and residential sites. Yellowknife is served by water and air services, and has a modern airport, local transportation services, stores, hotels, restaurants, a theatre, and a weekly newspaper. Recently, a modern public and high school, a new hospital, and a new hotel were constructed.

The larger settlements in Mackenzie District are served throughout the year by air transportation, and in summer by water transportation. Eastern Arctic settlements are serviced principally by the supply ships that carry the annual Eastern Arctic Patrol, and occasionally by unscheduled aircraft. Government and private commercial radio stations provide all-year communication at practically all settlements and posts.

In the following paragraphs will be found brief descriptions of most of the settlements and trading posts in the Northwest Territories, and those in the Provinces of Quebec and Manitoba served by the Eastern Arctic Patrol.

Aklavik, on west channel of Mackenzie River, 69 miles from Arctic Coast, Mackenzie District, N.W.T.—Resident Government Medical Officer; Stipendiary Magistrate and District Administrator; Royal Canadian Mounted Police detachment; post office; Government radio and meteorological station (Department of National Defence); trading posts; hotel; community hall; Church of England and Roman Catholic missions and hospitals; residential and day schools.

Arctic Bay, northern Baffin Island, Franklin District, N.W.T. — Winter harbour of Canadian Government Steamship "Arctic", 1909-10; Government radio and meteorological station (Department of Transport); private commercial radio station; trading post; Roman Catholic Mission.

Arctic Red River, at junction of Mackenzie and Arctic Red Rivers, Mackenzie District, N.W.T. — Royal Canadian Mounted Police detachment; post office; trading post; private commercial radio station; Roman Catholic mission.

Bache Peninsula, eastern Ellesmere Island, Franklin District, N.W.T. — Site of former Royal Canadian Mounted Police detachment and post office.

Baker Lake, at mouth of Thelon River, Keewatin District, N.W.T. — Royal Canadian Mounted Police detachment; Government radio and meteorological station (Department of National Defence); Ionospheric Station; emergency landing strip; Government scientific station; trading post; private commercial radio station; Church of England and Roman Catholic missions.

Bathurst Inlet (Burnside Harbour), Coronation Gulf, Mackenzie District, N.W.T. — Trading post; private commercial radio station; Roman Catholic mission.

Belcher Islands, Hudson Bay, Keewatin District, N.W.T. — Trading outpost.

Cambridge Bay, southern Victoria Island, Franklin District, N.W.T. — Royal Canadian Mounted Police detachment; trading post; private commercial radio station; Church of England mission.

Cape Dorset, Dorset Island, off Foxe Peninsula, Baffin Island, Franklin District, N.W.T. — Trading posts; private commercial radio station; Roman Catholic mission.

Cape Hopes Advance, Ungava Bay, Quebec — Government radio direction-finding and meteorological station (Department of Transport).

Cape Smith, Smith Island, eastern side of Hudson Bay, Keewatin District, N.W.T. — Trading post; private commercial radio station.

Chesterfield, western side of Hudson Bay, Keewatin District, N.W.T. — Resident Government medical officer; Royal Canadian Mounted Police detachment; post office; Government radio direction-finding and meteorological station (Department of Transport); trading post; Roman Catholic mission; hospital, and industrial home.

Churchill, western side of Hudson Bay, Manitoba. — Seaport terminus of Hudson Bay railway; National Harbours Board grain elevator, offices, and shops; Government airport and hospital; radio direction-finding and meteorological station (Department of Transport); Royal Canadian Mounted Police detachment; stores; Church of England and Roman Catholic missions.

Coppermine, at mouth of Coppermine River, Mackenzie District, N.W.T. — Royal Canadian Mounted Police detachment; post office; Government radio and meteorological station (Department of Transport); trading post; Church of England and Roman Catholic missions.

Coral Harbour, Southampton Island, Keewatin District, N.W.T. — Trading post; private commercial radio station; Church of England and Roman Catholic missions; Royal Canadian Mounted Police detachment; landing field; Government radio and meteorological station (Department of Transport) at Munn Bay, 5 miles distant.

Craig Harbour, southern Ellesmere Island, Franklin District, N.W.T. — Site of former Royal Canadian Mounted Police detachment and post office.

Diana Bay, Hudson Strait, Quebec. — Trading post.

Dundas Harbour, Devon Island, Franklin District, N.W.T. — Royal Canadian Mounted Police detachment and post office; former trading post.

Eskimo Point, western side of Hudson Bay, Keewatin Ditricts, N.W.T. — Royal Canadian Mounted Police detachment; trading post; private commercial radio station; Northern Evangelical Society Mission and Roman Catholic mission.

Eureka Sound, Slidre Fiord, western Ellesmere Island, Franklin District, N.W.T. — Government meteorological station (operated jointly by the Department of Transport and the United States Weather Bureau.)

Fort Chimo, Koksoak River, Quebec. — Royal Canadian Mounted Police detachment; post office; trading post; private commercial radio station; Church of England mission. Defence project landing field; radio and meteorological station, 7 miles distant; Ionospheric Station.

Fort Franklin, western end of Great Bear Lake, Mackenzie District, N.W.T. — Site of early Hudson's Bay Company fort used by Franklin expedition as winter headquarters 1825-26-27. At present a trading post.

Fort Good Hope, at junction of Mackenzie and Hare Rivers, Mackenzie District, N.W.T. — Royal Canadian Mounted Police detachment; post office; trading post; Government radio and meteorological station (Department of National Defence); private commercial radio station; Roman Catholic mission.

Fort Liard, on Liard River, near point where Yukon-Northwest Territories boundary intersects northern boundary of British Columbia, Mackenzie District, N.W.T. — Royal Canadian Mounted Police detachment; trading post; private commercial radio station; Roman Catholic mission.

Fort McKenzie, Koksoak River, Quebec. — Department of Transport station; Indian settlement.

Fort McPherson, on Peel River near junction with Mackenzie River, Mackenzie District, N.W.T. — Post office; trading post; private commercial radio station; Church of England mission.

Fort Norman, at junction of Great Bear and Mackenzie Rivers, Mackenzie District, N.W.T. — Royal Canadian Mounted Police detachment; post office; Government radio and meteorological station (Department of National Defence); trading posts; Roman Catholic mission; transfer point for all water-borne traffic proceeding to Great Bear Lake.

Fort Providence, on Mackenzie River just west of outlet of Great Slave Lake, Mackenzie District, N.W.T. — Royal Canadian Mounted Police detachment; Government radio and meteorological station (Department of National Defence); landing field; post office; trading post; private commercial radio station; Roman Catholic mission and residential school.

Fort Resolution, on Great Slave Lake near mouth of Slave River, Mackenzie District, N.W.T. — Resident Government medical officer who is also Indian Agent, Royal Canadian Mounted Police detachment; post office; Government radio and meteorological station (Department of National Defence); landing field; trading posts; Roman Catholic mission; hospital, and residential school.

Fort Ross, on Somerset Island, facing Bellot Strait, Franklin District, N.W.T. — Former trading post.

Fort Simpson, at junction of Mackenzie and Liard Rivers, Mackenzie District, N.W.T. — Resident Government medical officer, who is also Indian Agent; Royal Canadian Mounted Police detachment; post office; Government radio and meteorological station (Department of National Defence); landing field (8 miles distant); agricultural experiment substation; trading posts; Church of England and Roman Catholic missions and day schools; Roman Catholic hospital.

Fort Smith, on Slave River just north of Alberta-Northwest Territories boundary, Mackenzie District, N.W.T. — Offices of Stipendiary Magistrate and District Administrator; Superintendent, Forest and Wildlife Management; resident Government medical officer; and Royal Canadian Mounted Police detachment. Post office; Government radio and meteorological station (Department of National Defence); landing field and seaplane anchorage; trading posts; hotel; liquor store; transportation companies; Church of England and Roman Catholic missions; Roman Catholic hospital and day school; public day school.

Frobisher Bay, southern Baffin Island, Franklin District, N.W.T. — Royal Canadian Mounted Police detachment; defence project landing field; radio and meteorological station (Department of Transport). Trading post in vicinity of settlement.

George River, Ungava Bay, Quebec — Trading post; private commercial radio.

Great Whale River, Hudson Bay, Quebec — Trading post; private commercial radio station; Church of England mission.

Hay River, on Great Slave Lake at mouth of Hay River, Mackenzie District, N.W.T. — Post office; trading post; Government radio and meteorological station (Department of National Defence); private commercial radio station; Church of England and Roman Catholic missions; Church of England nursing home; terminus of winter road from Grimshaw, Alberta, now developed into an all-weather highway; landing field.

Holman Island, (King's Bay) Amundsen Gulf, Franklin District, N.W.T. — Trading post; private commercial radio station; Roman Catholic mission.

Igloolik, on island in Foxe Basin, northeast of Melville Peninsula, Franklin District, N.W.T. — Trading post; Roman Catholic mission.

Ivugivik, Hudson Bay, Quebec — Roman Catholic mission.

Koartak, immediately adjacent to Cape Hopes Advance, Ungava Bay, Quebec.—Roman Catholic mission.

Lake Harbour, southern Baffin Island, Franklin District, N.W.T. — Royal Canadian Mounted Police detachment; post office; trading post; private commercial radio station; Church of England mission.

Maguse River, mouth of Maguse River, Keewatin District, N.W.T. — Trading post.

Mansel Island, Hudson Bay, Keewatin District, N.W.T. — Former trading post.

Moffet Inlet, Admiralty Inlet, northwestern Baffin Island, Franklin District, N.W.T. — Church of England mission (unoccupied at present).

Norman Wells, on Mackenzie River, 48 miles north of Fort Norman, Mackenzie District, N.W.T. — Oil wells, first drilled in 1920, and refinery, erected in 1939, supply most of petroleum requirements of mining camps in Mackenzie District. Royal Canadian Mounted Police detachment; post office; landing field; trading post; Government radio and meteorological station (Department of National Defence); hotel; hospital.

Nottingham Island, Hudson Strait, Franklin District, N.W.T. — Government radio direction-finding and meteorological station (Department of Transport).

Nueltin Lake, Keewatin District, N.W.T. — Trading post.

Outpost Island, Great Slave Lake, Mackenzie District, N.W.T. — Gold-mining property.

Padlei, west of Maguse Lake, Keewatin District, N.W.T. — Trading post, serviced by aircraft from Eskimo Point; private commercial radio station.

Pangnirtung, on Pangnirtung Fiord, Cumberland Sound, eastern Baffin Island, Franklin District, N.W.T. — Resident Government medical officer; Royal Canadian Mounted Police detachment; post office; trading post; private commercial radio station; Church of England mission, hospital and industrial home.

Paulatuk, Darnley Bay, Amundsen Gulf, Mackenzie District, N.W.T. — Trading post; Roman Catholic mission.

Payne Bay, Ungava Bay, Quebec — Trading post; private commercial radio station.

Pelly Bay, Gulf of Boothia, Keewatin District, N.W.T. — Roman Catholic mission.

Perry River, on Queen Maud Gulf, Keewatin District, N.W.T. — Trading post.

Peterson Bay, (Gjoa Haven), King William Island, Franklin District, N.W.T. — Trading post.

Pond Inlet, northeastern Baffin Island, Franklin District, N.W.T. — Royal Canadian Mounted Police detachment; post office; trading post; private commercial radio station; Church of England and Roman Catholic missions.

Port Brabant, (Tuktoyaktuk), on Arctic Ocean east of mouth of Mackenzie River, Mackenzie District, N.W.T. — Exchange point for river and ocean traffic; trading post; private commercial radio station; Church of England and Roman Catholic missions.

Port Harrison, eastern Hudson Bay, Quebec — Royal Canadian Mounted Police detachment; post office; Government radio direction-finding and meteorological station (Department of Transport); trading posts; Church of England missions.

Port Radium, (Post office) Labine Point, Great Bear Lake, Mackenzie District, N.W.T. — Post office on property of Eldorado Mining and Refining (1944) Limited, a Crown company. In addition to the mine and mill, in vicinity are a Government radio and meteorological station (Department of National Defence), a Royal Canadian Mounted Police detachment, and seaplane anchorage. Port Radium post office was formerly situated at a settlement on Echo Bay, about 6 miles to the east (now abandoned).

Povungnituk, eastern Hudson Bay, Quebec — Trading post; private commercial radio station.

Rae, at head of north arm of Great Bear Lake, Mackenzie District, N.W.T. — Royal Canadian Mounted Police detachment; post office; trading post; private commercial radio station; Roman Catholic mission and hospital

Read Island, Dolphin and Union Strait, Franklin District, N.W.T. — Trading post; private commercial radio station.

Reindeer Depot, east channel of Mackenzie River about 60 miles from mouth, Mackenzie District, N.W.T. — Headquarters for field supervision of Government reindeer industry; headquarters building, warehouses, workshop; private commercial radio station.

Reliance, at eastern end of Great Lake Slave, Mackenzie District, N.W.T. — Royal Canadian Mounted Police detachment; trading post.

Repulse Bay, southern coast Melville Peninsula, Franklin District, N.W.T. — Trading post; private commercial radio station; Roman Catholic mission.

Resolute Bay, Cornwallis Island, Franklin District, N.W.T. — Government meteorological station (operated jointly by the Department of Transport and the United States Weather Bureau); Royal Canadian Mounted Police detachment; Ionospheric Station.

Resolution Island, eastern entrance to Hudson Strait, Franklin District, N.W.T. — Government radio direction-finding and meteorological station (Department of Transport).

Richardson Island, Coronation Gulf, Franklin District, N.W.T. — Trading post.

Richmond Gulf, east side Hudson Bay, Quebec. — Trading post; lead mines.

River Clyde, eastern Baffin Island, Franklin District, N.W.T. — Government ionospheric, radio, and meteorological stations (Department of Transport); trading post; private commercial radio station.

Snowdrift, southeastern shore of Great Slave Lake, Mackenzie District, N.W.T. — Trading posts; private commercial radio station.

Stanton, at mouth of Anderson River, Mackenzie District, N.W.T. — Trading post; Roman Catholic mission.

Sugluk, Hudson Strait, Quebec — Trading post; private commercial radio station; Roman Catholic mission.

Taltson River, (Rocher River), southern shore Great Slave Lake, Mackenzie District, N.W.T. — Trading post; private commercial radio station.

Tavani, Mistake Bay, western side Hudson Bay, Keewatin District, N.W.T. — Trading post; private commercial radio station; Roman Catholic mission.

Wager Bay, on Ford Lake, west of Wager Bay, Keewatin District, N.W.T. — Former trading post.

Wakeham Bay, Hudson Strait, Quebec — Trading outpost; Roman Catholic mission.

Wolstenholme (Eric Cove), at western end Hudson Strait, Quebec — Former trading post.

Wrigley, on west bank Mackenzie River, Mackenzie District, N.W.T. — Post office; trading post; private commercial radio station; landing field about 5 miles southeast on east side of river.

Yellowknife, on north shore of Great Slave Lake, about 5 miles south of mouth of Yellowknife River, Mackenzie District, N.W.T. — Mining settlement built up as result of prospecting and mining operations in the vicinity. Contains offices of Mining Recorder, Stipendiary Magistrate, and other Canadian Government officials; Royal Canadian Mounted Police detachment; post office; Government airport, radio range and meteorological station (Department of Transport); Government radio station (Department of National Defence); private commercial radio stations; public and high school; hotels; hospital; restaurants; banks; drug stores; tavern; liquor store; general stores; meat market; motion picture theatres; weekly newspaper; printing office; Church of England and Roman Catholic Churches; has electric light, water, and sewer services; also local motor, air, and water transportation services.

TRANSPORTATION

TRANSPORTATION is one of the most important factors in the development of northern Canada. On adequate water, highway, and air transportation services depend the safe delivery of large tonnages of supplies and equipment shipped each year to the sub-Arctic and Arctic regions, and the export of furs and minerals, which are the principal products of the North.

Mackenzie District

Mackenzie District and the Western Arctic are served principally by water and aerial transportation. There is no general highway system in the Territories, although an important new road is rapidly being completed to link railhead with Great Slave Lake. Truck and tractor roads suitable for motor traffic have also been constructed in the vicinity of settlements and mining communities, and between strategic points to facilitate the transportation of freight and supplies.

Inland Water Transportation

Since the great Northwest was first opened to commerce, water transportation services have borne the heaviest share of traffic. The Mackenzie River and its tributaries, the Athabaska and Slave Rivers, provide a direct inland water transportation route for a distance of about 1,700 miles. In addition, subsidiary routes on Lake Athabaska, Great Slave Lake, and Great Bear River and Lake total more than 800 miles. The main route is continuous except for one unnavigable stretch between Fort Fitzgerald, Alberta, and Fort Smith, N.W.T. The head of this avenue of transportation is Waterways, Alberta, terminus of a branch of the Northern Alberta Railways, 300 miles north of Edmonton. From Waterways, freight and passengers are transported by water to Fort Fitzgerald, where a 16-mile portage to Fort Smith, gateway to Mackenzie District, is necessary to avoid a series of rapids on the Slave River. Northbound traffic is transferred around this obstruction by motor vehicles over well-maintained roads to wharves at Fort Smith and at Bell Rock. There is uninterrupted navigation from Fort Smith to the Arctic Ocean.

Services on the Mackenzie River route were first provided by canoes, and later by the picturesque York boats of the Hudson's Bay Company. Steamboat service on the Athabaska-Slave Rivers section of the route was inaugurated in 1884, and, in 1886, a similar service was commenced from Fort Smith to Fort McPherson. Services were also maintained on the Peace River for many years.

General freight services on the Mackenzie River system are maintained by three water transportation companies viz. the Northern Transportation Company, Limited; Yellowknife Transportation Company, Limited; and McInnis Products Corporation Limited. The Hudson's Bay Company, which for nearly half a century operated water transportation services from Waterways to the Arctic, decided at the close of the 1947 season to restrict its activities to supplying its own trading posts. The company, however, will continue to supply the Western Arctic, and will operate as a common carrier specifically from Waterways to Port Brabant (Tuktuk). Freight destined for the Western Arctic Coast will be distributed from the latter point. Additional information concerning passenger and freight rates, as well as dates of sailings, may be obtained from the offices of the above-mentioned companies at Edmonton, Alberta.

All these companies have modern loading facilities and docks at their southern termini, and adequate equipment at the larger settlements for the handling of freight. Many of the boats in service burn oil, are equipped with radio, and are in regular communication with stations en route. Canoes are still used extensively on the smaller lakes and rivers, and motor boats also provide transportation at many points.

Coastal Services

For many years, the Western Arctic coast was served by ocean-going vessels from Pacific Coast seaports via Bering Strait, but for various reasons this service was discontinued. Vessels operated by the Hudson's Bay Company which connect with Mackenzie River services at Port Brabant provide freight services to points along the coast. Occasional transportation along the coast is also provided by schooners operated by traders and Eskimos.

Aerial Transportation

The use of aircraft has contributed greatly to developments in Mackenzie District. This form of transportation was first introduced during the winter of 1920-21 by Imperial Oil, Limited, and since then extensive exploration of the region has been made by air. Mackenzie District is particularly suited to the use of aircraft equipped with pontoons or skis, as it is dotted with lakes and traversed by rivers of sufficient size to permit safe landings in summer and in winter.

During the war, existing landing strips were greatly improved and many other fields developed to permit the operation of wheel-equipped aircraft throughout the year. These fields are situated at Fort Smith, Fort Resolution, Hay River, Yellowknife, Fort Providence, Fort Simpson, Wrigley, and Norman Wells. Maintenance of some of these fields, however, has since been discontinued, and those at Fort Providence, Fort Simpson, and Wrigley are not used in winter. Landing strips have been constructed on Great Bear River and at Sawmill Bay on the east side of Great Bear Lake to facilitate mining operations. The airport which serves the settlement of Yellowknife is one of the most modern in northern Canada. It is equipped with a radio range station and is capable of accommodating large passenger and freight planes.

Regular passenger, mail, and express services by air are maintained throughout the year to many points in Mackenzie District. Canadian Pacific Air Lines maintain services from Edmonton to Fort Smith and Yellowknife daily except Sunday, via McMurray. Services are also provided twice weekly to Hay River and Yellowknife via Peace River. From Yellowknife, air services are provided regularly every two weeks to Rae, Indin Lake, and Port Radium, and twice monthly to Coppermine. In addition, Fort Providence, Fort Simpson, Norman Wells, Fort Good Hope, Arctic Red River, Fort McPherson, and Aklavik have air service twice a month in summer and once a month in winter. Wrigley and Fort Norman are served from Norman Wells in summer. In winter all "down-river" settlements are served from Yellowknife. Some of these services are suspended for short periods during "break-up" and "freeze-up." Most passenger aircraft have two-way radio permitting continuous communication with stations in the Northwest Territories.

Roads

Roads in the Mackenzie District include two portage roads, each about 16 miles long, which permit travel from Fort Fitzgerald to Fort Smith, and an extension from Fort Smith to the shipyard and wharves at Bell Rock,

8 miles distant. Roads constructed in the vicinity of Yellowknife serve the airport at Long Lake, and the Con-Rycon, Negus, Giant Yellowknife, Ptarmigan, and Crestaurum mining properties. A portage road built along the Great Bear River for a distance of 8½ miles assists in the movement of freight to and from Great Bear Lake.

A recent development has been the construction of an all-weather highway from railhead at Grimshaw, Alberta, to Hay River settlement on Great Slave Lake. The work was carried out as a joint project by the Province of Alberta and the Government of Canada, with the Dominion Government bearing the entire cost of the 81-mile section within the Northwest Territories, and two-thirds of the cost of the 275 miles being built in Alberta. The route follows generally that of a winter road which has been utilized in the past for transportation of freight by tractor train. The road was opened to traffic in 1948 and is expected to facilitate the movement of freight to Yellowknife and to settlements on the Mackenzie River.

Eastern Arctic

For many years, the Eastern Arctic was served principally by R.M.S. *Nascopie*, a vessel owned and operated by the Hudson's Bay Company. Under contract to the Government of Canada, the vessel carried the annual Eastern Arctic Patrol and visited medical centres, Royal Canadian Mounted Police detachments, post offices, radio and meteorological stations, trading posts, and missions in the region. The *Nascopie* was lost, however, after it grounded on a reef in Hudson Strait, off Cape Dorset, during the 1947 patrol. Supplies for the various posts usually served by the *Nascopie* were later delivered by smaller vessels owned or chartered by the Hudson's Bay Company.

The Eastern Arctic Patrol involves a voyage of more than 10,000 miles to posts in northern (Arctic) Quebec, on the west coast of Hudson Bay, on islands in Hudson Strait and Hudson Bay, and in the Arctic Archipelago. The party, headed by the Chief of the Arctic Division, Northwest Territories Services, Department of Mines and Resources, usually includes administrative and medical officers, Royal Canadian Mounted Police personnel, technicians, and others going north to relieve those who have completed terms of service in the Arctic. Scientific parties representing various Government departments and other agencies also accompany the expedition. Ports of call are visited for inspection, administration of justice, delivery and acceptance of mail, change of personnel, and replenishment of supplies. Occasionally, Eskimo families are transferred to more abundant hunting grounds.

The patrol normally starts and finishes at Montreal, and up to 1947 called at Churchill, Manitoba, to refuel for the northbound journey and pick up passengers, mail, and freight arriving there over the Hudson Bay Railway. On the return voyage, the patrol collects fur at the various ports of call. The patrol normally extends over a period of about fourteen weeks during which about 20 calls are made by the main supply vessel and an additional 30 calls by small auxiliary vessels. The total annual mileage by all vessels and aircraft connected with the patrol usually exceeds 20,000 miles.

A radical change in transportation arrangements for the Eastern Arctic is under way. The various posts and settlements have become too numerous for one vessel to serve adequately during the short summer season, and, to meet requirements, a new vessel is now under construction for the Depart-

ment of Transport. It is expected that this vessel will patrol to Baffin Island and the more inaccessible central and northern Arctic Islands. New vessels being constructed for the Hudson's Bay Company will be used principally in servicing posts in Hudson Bay and Strait.

The Department of Transport ice-breaker *N.B. McLean* aids vessels in the navigation of the Hudson Bay Route. It enters Hudson Strait early in the season to inspect, repair, and service all aids to navigation, including buoys, lights, and radio and direction-finding stations. It also patrols the route and provides ships with information concerning ice and other conditions. The Baffin Trading Company usually charters a vessel each summer to serve its posts at Diana Bay, Cape Dorset, and Port Harrison. In 1947, a new schooner, the *Regina Polaris*, was placed in service by the Roman Catholic Church to carry supplies to its missions in Hudson Bay and Strait. In addition, small schooners operating out of Churchill and Moosonee serve the coasts of James Bay and Hudson Bay. Power boats known as "peterheads" provide local transportation and may be found at nearly all Eastern Arctic settlements.

Commercial air services have not yet been established in the Eastern Arctic. Landing fields, however, were constructed during the war as defence projects on Southampton Island and at Frobisher Bay, on Baffin Island, to link up with bases at Churchill, Manitoba; Fort Chimo, northern Quebec; and those in southern Greenland. Landing fields at these points, and at Baker Lake, are available for use when required. Flying boats and pontoon-equipped aircraft have also been used in locating control points for future air photography and mapping operations, as well as for special or mercy flights.

Winter travel in the Eastern Arctic is carried out almost entirely by dog-teams and komatiks or sledges, a mode of travel that has been used by the Eskimos for centuries.

COMMUNICATIONS

Mail Services

Mackenzie District

MACKENZIE DISTRICT receives its mail exclusively by air. Prior to 1930, mail was carried by water in summer and by dog-team in winter. Following some experimental mail-carrying flights in 1929, mail planes were put into service and operated frequently. Later, air mail contracts were let, and definite schedules have been maintained for a number of years. Whereas, at one time, weeks and months were required to deliver mail, it is now done in a matter of hours. Postage rates have been kept as low as possible, and letters are carried by air at regular letter-postage rates, if not overweight. Parcels are subject to a higher rate than those carried by ordinary means of transport.

Fort Smith and Yellowknife have all year postal service several times each week from Edmonton, via McMurray. Fort Resolution has a weekly service and Hay River, Fort Providence, Fort Simpson, and Norman Wells receive mail twice a month. Wrigley, Fort Norman, Fort Good Hope, Arctic Red River, Fort McPherson, and Aklavik have monthly postal service from Edmonton, via McMurray. Port Radium (Eldorado) is served weekly, and Rae twice a month in summer from Yellowknife. Coppermine has a service twice a year (January and July). Post offices have been established at the above places.

In addition to the above services, mails may also be carried on commercial flights as circumstances permit.

Eastern Arctic

Post offices are located at Chesterfield in Keewatin District, Fort Ross, Lake Harbour, Pangnirtung, Dundas Harbour, and Pond Inlet in Franklin District, and Fort Chimo and Port Harrison in northern Quebec. The annual Eastern Arctic Patrol delivers mail to all post offices and arranges for vessels to collect and deliver at points without post offices through locally operated auxiliary services.

All classes of mail matter are centralized at Ottawa, and are carried by the Patrol or by auxiliary or courtesy services as opportunities arise. This travelling postal service is classified as an accounting post office and is available for post office savings bank transactions, money orders, postal notes, parcel post C.O.D. services, and current issues of postage stamps. Postal parcels originating in foreign territory addressed to Eastern Arctic residents, and on hand at the office of the Collector of Customs at Ottawa, are released for delivery by the Patrol, subject to the collection of all charges. Additional information concerning postal services may be obtained by writing to the Director of Communications, Post Office Department, at Ottawa.

Radio Services

Excellent radio services have been maintained in the Northwest Territories since 1925. High-powered stations have been installed by the Canadian Departments of National Defence and Transport at strategic points and important settlements in Mackenzie District and in the Eastern Arctic. In addition, nearly all settlements, mining communities, and trading posts are now equipped with two-way private commercial radio stations, by means of which communication may be carried on in code or by voice. Although this type of station has a limited range, messages can be relayed through the more powerful Government stations, and by this means practically every settlement or trading post in the Territories enjoys radio communication with outside points.

In the Eastern Arctic, several Government radio stations are also direction-finding stations for ocean-going vessels. The combined system of Government stations and licensed stations is also used to transmit weather reports, to obtain information in emergencies for the treatment of sick people in remote districts where medical services are not available, and to arrange for emergency aeroplane flights when necessary. Many of the Government stations are equipped with radio telephones for communicating with aircraft, river boats, and other stations having low-powered radios.

Government stations occasionally provide broadcasts of press news and personal messages for the benefit of traders, miners, missionaries, and others within their wave-lengths. For a number of years, the Canadian Broadcasting Corporation has broadcast the "Northern Messenger" program weekly during the winter months. By means of this service, relatives and friends are able to send personal messages to residents of the Northwest Territories and adjacent areas, a privilege greatly appreciated by all concerned.

CLIMATE*

THE NORTHWEST TERRITORIES have two main climatic divisions. The northeastern region, including the islands of the Arctic Archipelago, has an arctic climate. It includes all the region north of the tree-line extending in a general southeasterly direction, from the mouth of the Mackenzie River to the west coast of Hudson's Bay just north of Churchill, Manitoba. The average temperature of the warmest month is *less* than 50°F. Average winter temperatures are all below 32°F. The remainder of the Northwest Territories and Yukon has what is known as a sub-arctic climate, in which average temperatures for the coldest month are below 32°F., but average temperatures for the warmest months are *above* 50°F. Although both regions are cold in winter, the chief distinction between them is in summer temperatures, with the western sections being much warmer. The climate of this latter region is thus similar to that found in Ontario, north of Lake Superior, and in Quebec, north of the Gulf of St. Lawrence. There are local areas of arctic climate in the mountain peaks within the Continental climatic region, due to the cooler effects of altitude.

There are several controls which in the long run maintain differences between the northeastern and western districts of the Northwest Territories. In mid-winter, the entire Arctic territory is subject to periods of great cold, which are associated with the slow outflow of shallow, but extremely dry and cold domes of surface air from the Arctic Ocean by way of the Beaufort Sea. These air masses move in mid-winter up the Mackenzie Valley and spread out over the Canadian prairies before showing a tendency to drift eastward. Intermittently, these polar outbursts cease for short intervals, and warmer air from the North Pacific region or from the Bering Sea by way of the Aleutians will flow over the region, causing temperatures in the Mackenzie Valley to rise. Depending on which of these controls is most dominant, the winter of the Mackenzie District may be moderately cold or extremely cold and will vary from year to year.

At the same time, the Eastern Arctic is under the influence in mid-winter of polar airmasses moving southward from the Arctic Ocean toward Manitoba and James Bay. Passing over the large amount of cold water which moves south and eastward from the Arctic Ocean through the Arctic Islands to Davis and Hudson Straits, these air-masses remain cold as they move. Thus, winters in the Eastern Arctic are more constant with few mild periods. Occasionally, arctic air warmed off the Labrador Coast returns northward, but it affects southeastern Baffin Island only.

In summer, airmasses from the Beaufort Sea have a strong eastern component of motion and tend to move directly across the Northwest Territories to the Eastern Arctic. This cold air-drift, when combined with the influence of large bodies of Arctic water which remain cold throughout the summer in Hudson Bay and the many straits between the Arctic Islands, results in cool summers in the eastern regions. The average annual highest temperature does not exceed 50°F. north of latitude 70°.

The eastward shift of the paths of cold airmasses in summer allows warm air from the North Pacific region or from more southerly latitudes to flow north and northeastward, bringing mild weather to the Mackenzie area.

Summers may occasionally become really hot under this influence. Temperatures over 90°F. have been recorded in most summers. However,

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* Compiled from information supplied by the Meteorological Division, Department of Transport, Toronto.

there are also summers when polar outbursts are more intense or more frequent, or both, and tend to follow a more westerly path. This causes cooler weather in the Mackenzie Valley but has the compensating advantage of heavier precipitation in the wheat region south of latitude 60.

The central and northern portions of the Arctic Archipelago seldom obtain any relief from purely polar conditions. Temperatures average 25° to 35°F. below zero in January and only 40° to 42°F. in July.

Because of the northern latitude of the Northwest Territories, there are long hours of daylight during the summer, and this fact is often advanced in support of agricultural possibilities in the Mackenzie Valley. However, since southern Baffin Island in the Eastern Arctic has no agriculture although in the same latitude and with the same duration of sunlight as the Mackenzie Valley, it is apparent that other climatic factors act as controls. Basically, agriculture is not possible in the Eastern Arctic because of lack of developed soil, and the coolness of the summer, which gives a short frost-free period; agriculture is possible, although somewhat precarious, in northwestern Canada because of the warm air masses which raise summer temperatures.

Contrary to general belief, snowfall is not heavy in the Northwest Territories. Because of low winter temperatures, however, snow remains on the ground for a long time. Annual precipitation of 10 to 13 inches in the Mackenzie Valley includes 40 to 50 inches of snow, which is about half of the snowfall of the Great Lakes, St. Lawrence River, and northern New England regions. Rain falls from July to October, but is not overly abundant. Precipitation is even less in the Arctic Islands and over the central Arctic mainland, averaging 6 to 9 inches, most of which falls as snow. Southeastern Baffin Island is an exception, since air from the south often rises over this area, bringing an average of approximately 8 inches of rain and 70 to 90 inches of snow.

The following comparison of mean temperatures by latitude in Canada and Europe illustrates the climatic difference between the eastern and western sections of the Northwest Territories and compares them with stations near the same latitude in Europe.

	January	*July*
Near Latitude 60°N.		
Fort Smith, N.W.T.	–16°F	60°F
Cape Hope Advance, N.W.T.	– 9	41
Bergen, Norway	34	58
Marieham, Finland	27	59
Near Latitude 65°N.	*January*	*July*
Fort Good Hope, N.W.T.	–24°F	59°F
Pangnirtung, N.W.T.	–19	46
Uleaborg, Finland	15	59
Jockmokk, Sweden	6	58
Near Latitude 75°N.	*January*	*July*
Craig Harbour, N.W.T.	–22°F	41°F
Bear Island (off Norway)	15	40
Near Latitude 80°N.	*January*	*July*
Bache Peninsula, N.W.T.	–27°F	41°F
Quade Hook (Spitzbergen)	7	40

Until recent years, meteorological records of settlements and trading posts in the Northwest Territories were quite limited. Most of the radio stations now operated by the Departments of National Defence and Transport also serve as weather stations, and comparative records covering longer periods are gradually being acquired. The most recent development in the far north has been the establishment of meteorological stations which are operated jointly by the Canadian Department of Transport and the United States Weather Bureau.

ABORIGINES

Indians

MOST of the 4,000 Indians in the Northwest Territories live in the valley of the Mackenzie River, the principal tribes being the Chipewyan, Beaver, Sekani, Slave, Yellowknife, Dogrib, Hare, Nahanni, and Kutchin or Loucheux. The Kutchin Indians, native to the Yukon and Alaska, are found in the Northwest Territories only in the Lower Mackenzie and Peel Rivers regions. They constitute one branch of the Athapaskan stock. The remaining tribes of the Northwest Territories may be regarded as constituting another branch because their languages are mutually intelligible, whereas that of the Kutchin is distinct although obviously related.

Some scientists hold the view that the Athapaskan language, spoken by the Indians throughout the whole basin of the Mackenzie River, belongs to the same family of languages as prevails in China, Tibet, and Siam. Moreover, from the concentration of the Athapaskans in the northwestern part of America, they conclude that these people were the last wanderers to drift from Asia across Bering Strait into the New World, probably toward the beginning of the Christian era. From the Indians themselves, of course, no accurate knowledge can be gained of their origin or early movements. Their oral traditions are quite unreliable, for they combine with impossible fables memories of events which occurred no more than 150 years ago.

The present day Athapaskan has copied the dwelling and the clothing of the white man. The old-fashioned moccasin, however, holds its ground, though ornamented with beads instead of with porcupine quills; and the old fur or leather mittens, often similarly ornamented, are still preferred to ordinary gloves.

Intertribal raids came to an end about a century ago, and the Indians began to congregate about the posts and settlements of the fur-traders, who tried, not very successfully, to elevate the most influential and reliable hunters as chiefs and to give them a limited authority over their countrymen. Missionaries have introduced new and larger ideas of life and its purpose that partly supplant, partly coalesce with, the older notions. In consequence, every Indian in the Territories now adheres to the Anglican or the Roman Catholic faith, though he may still harbour many of his old beliefs. In recent years, exploration, settlement, and mining activities have led to a demand for Indian guides, canoe-men, and packers, and resulted in an increasing dependence on flour, beans, bacon, and other imported foods instead of on the rewards of hunting and fishing. From the earliest times, too, many white traders and trappers have taken Indian women as wives, and more or less consciously have leavened the whole outlook and manners of the tribes among whom they have resided. So great, indeed, has been this intermarriage that today in the whole area there are probably few Indians of pure stock.

Thus, through economic and social changes, both the outward and the inward lives of the Indians have altered. Over a long period — most of the nineteenth century — these changes threatened to bring about the extinction of the race. Alcoholic excesses and diseases previously unknown, particularly smallpox, tuberculosis, and influenza, decimated their ranks and reduced their number from what was estimated by some authorities to be 13,000 to one-third of that total. Nevertheless, the outlook for the future has become much more promising. It is confidently felt that increasing settlement, and a great development of the resources of the Territories, will open up new avenues of employment for the Indians, lower their heavy infant mortality,

and, through a general improvement in the living conditions, arouse in them new vigour and new ambitions.

The Indians of the Northwest Territories depend mostly upon hunting and trapping for a livelihood. Here and there some cultivate small plots of potatoes. They own no cattle or horses, travelling by boat along the great waterways in the summer and by dog-team in the winter. In summer, they catch and preserve large quantities of fish and pick and dry large quantities of wild berries for winter use. They live in log cabins in the winter and in tents and tepees in the summer. Like Indians of other parts of Canada, they are under the care of the Dominion Government, and their affairs, with the exception of medical care, are administered by the Indian Affairs Branch of the Department of Mines and Resources, Ottawa. The Indian welfare program in the Territories consists in the main of the provision and protection of their means of livelihood; medical care and hospitalization of the sick; education of the children; payment of treaty money; payment of family allowances in kind; provision of relief rations for the old and physically incapacitated; and the furnishing of supplies and equipment which particular circumstances may require.

Anything that interferes with the success of their hunting and trapping causes hardship and destitution. Special game preserves have been set aside for the exclusive use of Indians and Eskimos, a plan that has proved satisfactory both in game conservation and as a protection for the natives.

Since November 1, 1945, the Indian Health Services of the Department of National Health and Welfare have been responsible for the medical care and hospitalization of Indians and Eskimos. Doctors employed by that Department are stationed at Fort Smith, Fort Resolution, Fort Simpson, and Aklavik in Mackenzie District; Chesterfield Inlet in Keewatin District; and Pangnirtung in Franklin District. In addition to acting as medical health officers for the district in which they are located, these doctors also serve the local hospitals. Some of them also act as Indian Agents in Mackenzie District.

In the more remote places, medical supplies are issued to missionaries and other laymen, who render the best service they can to ailing Indians. In the hospitalization of the sick, full use is made of the hospitals operated by the Anglican and Roman Catholic missions at Fort Smith, Fort Resolution, Fort Simpson, Aklavik, and Rae, in return for which grants, based on established per diem rates, are made by the Government to the missions.

To meet the educational needs of Indian children, the Government has established residential and day schools, particulars of which will be found in the section dealing with education on page 8.

Eskimos

The Eskimos in Canada inhabit the Arctic mainland coast from the Yukon-Alaska boundary to the coast of Labrador, the southern islands of the Arctic Archipelago, some of the islands in Hudson and James Bays, and part of the interior west of Hudson Bay. The Canadian Eskimo population is approximately 7,650. Of this number, about 5,650 Eskimos are found in the Northwest Territories, and the greater part of these live in the Districts of Franklin and Keewatin. There are also about 2,000 Eskimos in northern Quebec, the former Ungava District of the Northwest Territories.

There are no Eskimo tribes as the term "tribe" is associated with North American Indians, but the Eskimos of the Eastern Arctic live and travel in bands or groups of two or more families, and each band or group usually contains some outstanding individual who acts as leader.

Because of this lack of tribal organization and the fact that native Eskimo names are not only difficult to record accurately but are quite often duplicated, the Northwest Territories Administration distributed numbered discs in 1941 to all Eskimos in Canada. This distribution was carried out in conjunction with the decennial census of the Dominion, and to the census record of each Eskimo was added a number corresponding to that on the disc issued to that individual. Through this system of numbers, the Department now has a personal record of each Eskimo. The numbered discs worn by the Eskimos permit positive identification at all times and help overcome difficulties formerly experienced in the identification of an individual whose name, for various reasons, created confusion. The new system of identification also facilitates the administration of affairs relating to the welfare and health of the Eskimos.

Contacts between the bands are limited mainly to the natives hunting or trapping in adjoining areas. Each band secures its livelihood in its own district, which has no definite boundaries, and bands move about in accordance with the movement of the game and the changing season. In bad seasons it may become necessary to look for new hunting grounds, but Eskimos are very likely to return to the old districts when they think conditions have improved. The sea furnishes the greater part of the food, fuel, and clothing of the coastal Eskimos. Those living in the interior of Keewatin District subsist chiefly on caribou.

Because of outside influences and the shortage of native clothing material, the dress of the Eskimos has undergone change in recent years, the extent of the change depending on the game resources of the particular district. Summer clothing is cut very much on the same pattern as that for winter. Caribou skin is without doubt the most suitable clothing material for winter travel, being light and warm. In the very cold weather, two suits are worn, one with the hair turned in and the other with the hair turned out. In the summer, the clothing is usually made of sealskin or of some cotton goods, such as "moleskin". High sealskin boots or moccasins are worn both summer and winter. The women make most of the clothing, and the portable type of sewing machine is a common article of equipment.

The Eskimos of the Eastern Arctic live in snow houses in winter and tents in summer. Sealskin, canvas, sacking, pieces of board, stone, and even glazed sash may go to make up the tents or houses.

The igloo is the typical winter dwelling. It is constructed of blocks cut from the hard-packed snow, and above the first row the blocks are laid spirally to form a dome. It has a low, tunnel-like entrance, and often several compartments, which are connected by tunnels. One section of the igloo floor is higher than the rest, and is used as the sleeping platform. The stone seal-oil lamps, which are kept burning day and night during cold weather, raise the temperature noticeably and make the dwelling quite comfortable. The temperature is partly controlled by means of a ventilation hole in the roof. Many igloos are lined with canvas or sealskin to prevent drip.

The nature of the summer and winter dwellings, aside from wooden or composite houses, does not restrict the Eskimos' movements to one locality, which is fortunate from the viewpoint of health and sanitation. The type of habitation depends upon local and seasonal conditions. In the Western Arctic, whenever possible, the Eskimos have "permanent" homes, in which they reside in winter. They use driftwood for fuel and for the construction of one-roomed log huts. The Hudson's Bay Company and the Royal Canadian Mounted Police frequently provide their native servants with small homes of wooden construction for use as winter residences. These are regularly inspected and kept in a sanitary condition.

Eskimos travel by boat in summer, and by dog-team in winter. The usual type of cruising boat is the open whaleboat, to which a sail is attached. Other types are also brought in on order by the trading companies and are equipped, when the owners can afford it, with gasoline engines. Eskimos are mechanically-inclined and with a little coaching quickly learn to run, take down, and keep in repair quite complicated marine engines. They know thoroughly the districts in which they hunt and trap, also the actions of the tides, currents, and ice, and go out to sea under conditions which would keep many white men ashore. Into these boats will crowd three or four families and all their dogs and equipment. The natives seem to travel in the picnic spirit and consider a trip something of a lark. They may get into serious difficulties, but once the difficulties are overcome they are forgotten.

The one-man kayak is still used extensively by the Eskimos and is probably the outstanding article of equipment made by these remarkable people. The frame is made of wood, strongly laced together with thong. The craft is narrow, is covered with sealskin, and is usually from 15 to 20 feet long. As the deck is also covered with sealskin, the kayak is quite seaworthy in the hands of an experienced Eskimo. It is propelled by a double-bladed paddle, and carries all the equipment necessary for the hunting of seals. It is usually towed behind a large boat or hoisted up on the deck when the family or families are on the move.

The sledge or komatik used in the Eastern Arctic will support loads of one thousand pounds or more, depending on the size, and will stand considerable hard usage. It is drawn by teams of Eskimo dogs or "huskies."

Dog feed is a problem at times, and is one of the matters in which Eastern Arctic Eskimos are provident. They know that their own livelihood during the long winter months depends in large measure on their dogs. A certain amount of meat is cached away during the late summer, but it is seldom sufficient and may not be readily available. Eskimo dogs are able to go for some time without food, and if the hoped-for game does not materialize for a few days no harm results. Walrus meat is considered to be the best dog food. Seal meat and some types of fish are also good.

Practically the sole medium of exchange used by the Eskimos in their dealing with traders is the pelt of the white fox. During a good fox year, the Eskimos are able to replace their worn-out gear, and satisfy their longing for new goods. The Eskimos do not, as a rule, buy luxuries until they have obtained the essentials they require. In this they are encouraged by the better traders. Very few Eskimos are able to accumulate much in the way of worldly goods or to establish credits at the trading posts; in fact, allowing a credit to stand at a trading post is something that the average Eskimo cannot comprehend. The traders, of course, depend entirely on the natives for the pelts they want, and must see that they are looked after in bad times. Seal, walrus, and caribou are also of great importance to the Eskimos. Arctic char (sea trout) is fairly abundant at the mouths of rivers during July and August, and cod may be caught in quantity at the right season in certain localities.

Domestic relationships are usually happy. Eskimos are fond of children, but large families are not common, although infant mortality is low. If they have no children of their own, they will adopt those of others, caring for them as if they were their own. They also accept without visible or audible protest the responsibility of looking after their aged and otherwise dependent relatives. A refusal to continue to furnish food to those in want, even though the needy ones show little tendency to go out and hunt for themselves, is likely to be frowned upon by the rest of the band.

The Eskimos are quite trustworthy, and are invaluable companions in Arctic travel. As employees of white men, they are likely to obey orders without question even though they think the orders are bad. This sometimes results in misunderstanding on the part of white men who are unfamiliar with this trait of Eskimo character and are not very specific in giving their orders. Both men and women are intelligent and quick to imitate or learn, and possess a mechanical turn of mind that permits them to take rapid advantage of mechanical power and labour-saving devices. Their outlook on life is cheerful, and their dispositions are friendly.

The duties of the Eskimo women are arduous and varied. They must pitch the tents when a new camp-site is occupied; cook the meals; scrape and dress skins for clothing, harness, and lines; make the clothing for the family, and keep it in repair. On the men falls the responsibility of keeping the family supplied with food and the skins out of which clothing may be made. They must also secure the fox pelts so that trade goods may be obtained from the posts. Much of their time is spent hunting seals, the staff of life of the coastal Eskimos. During the summer, when kayaks can be used, seal hunting usually does not entail very much hardship. During the remainder of the year, when the seals are obtained at the floe edge or at "breathing holes" in the ice, it calls for the exercise of considerable patience and ingenuity under very trying conditions. The walrus is usually hunted in the water from the larger boats, or on islands. Although most Eskimos have a walrus or seal harpoon, the rifle is commonly used.

Caribou hunts are arranged in the autumn particularly for the hides which are required for winter clothing. In the Eastern Arctic, it is usually necessary to go some distance inland for caribou, and two months or more may be spent in travelling and hunting. Dogs are taken along to help "pack" the meat and hides. A good pack-dog can carry a load of 35 to 40 pounds. Surplus hides or meat are cached under rocks and picked up when winter travel with sledges is possible.

In the Western Arctic, the Eskimos spend most of their time along the coast, but go inland on hunting expeditions, chiefly for caribou. There is a short season of open water in midsummer, but for eight months of the year the sea is frozen over; thus the Arctic Ocean itself provides a happy hunting ground for the Eskimos, over which they travel and live as if it were solid ground. The Eskimos move out on the ice to the sealing grounds, and it is then that many of them use the snow-house. These sealing camps may be from 5 to 20 miles out on the ice, and are frequently used as bases for trapping operations.

In some regions, as summer makes its appearance, whale boats are put in order, and with the first open water the Eskimos proceed to the whaling grounds, where they fish for white whale. A successful whaling season means prosperity for all. The flesh of the white whale is used for both human and dog food. The oil is extracted from the blubber and is stored in barrels or sealskin bags for use as part of the meals in the winter. Natives who do not possess whale-boats carry on their fishing and whaling from the shore.

The habits and culture of the Eskimos in Canada vary according to environment. The Eskimos in the Mackenzie delta region have been more affected by the influences of civilization than those living elsewhere. Many of the former are relatively prosperous, own schooners, wear white men's clothing much of the time, and are able to carry on business with traders with ease. Eskimos of the Central Arctic, who have been relatively inaccessible by boat owing to ice conditions which hinder transportation, still retain much of their primitive culture and depend greatly on the resources of land and sea for their food, clothing, and utensils. The Eskimos of the Eastern Arctic

are in a stage of civilization midway between that of Central and Western groups. While able to obtain many of the implements and utensils of the whites, these Eastern Arctic Eskimos have clung to much of the old mode of living, and thus have successfully adapted themselves to their particular environment.

For generations, the Eskimos of Canada have lived in a country in which only a hardy and intelligent race could survive. They are slowly assimilating a certain amount of civilization while still retaining their independence, pride, and ability to care for themselves. Most of them now appreciate the value of conserving the natural resources of the country in which they live, and co-operate in that work to a marked degree. Even though they may not always quite understand its meaning and purpose, the natural tendency of the Eskimos is to obey the law. Their communal life has taught them that the wishes of the individual must be subordinate to the good of the majority, and this has made them especially easy to deal with. For a number of years, the Government of Canada has been paying special attention to its Arctic citizens, in order to keep them independent, self-reliant, and self-supporting, and with this object in view has put forth continuous efforts to preserve the natural resources of the country.

FLORA

Forests

THERE is no forest industry in the usual sense of that term in the Northwest Territories, nor is there any prospect of such an industry developing on a considerable scale. What forests there are, however, should be sufficient to meet the needs of the residents in perpetuity, provided reasonable protection from forest fires is afforded. The principal tree species are aspen and balsam poplar, white and black spruce, white birch, tamarack, and jack pine. The eastern part of the Territories is practically devoid of forests, but in Mackenzie District there are several areas of forested land, varying in nature from scattered clumps of stunted conifers and birches near the northern limits of tree growth to fairly heavy stands of poplar and spruce in the vicinity of the larger rivers. These forests are of value chiefly as a source of building materials and fuel for use by the local population, and as a favourable environment for fur-bearing and game animals.

Owing to the high cost of transportation, most of the lumber used in the Northwest Territories is manufactured locally. Small sawmills, usually equipped with planing machines, are operated at various points on the Slave River, Great Slave Lake, and the Mackenzie River. Most of the lumber sawn is white spruce, and the wood of this species is used for all parts of buildings. It is also in demand for boat-building and for almost every other purpose for which lumber is used.

The limited supplies of tamarack, because of the toughness and durability of this species, are well adapted for use in certain parts of boats and make excellent ground sills for buildings. White birch is used by the natives for snowshoe frames and for framing canoes, although its bark has been largely superseded by canvas for canoe covering. Black spruce is occasionally sawn in small quantities, and this species and jack pine are used in the construction of log cabins. The poplars are used chiefly for fuel, and fuelwood is the most important forest product in the Northwest Territories. The quantity of standing timber available for fuel is augmented by the large amount of driftwood which annually finds its way into the Mackenzie River.

The notable development of the mining industry during recent years has created new demands for building material and fuel-wood in the vicinity of the mines. Unfortunately, the increase in prospecting has greatly increased the danger of forest fires.

All forested lands within the Territories are included in four sub-divisions or sections of the Boreal Forest Region. Two of these, the Mixedwood and Northern Coniferous Sections, are represented by relatively small areas adjacent to the boundaries of Alberta and western Saskatchewan. The remainder is included in the Mackenzie Lowlands and Northern Transition Sections.

The Mixedwood Section occupies a small area along the Alberta boundary south of the west end of Great Slave Lake and the Mackenzie River. It is believed to afford the best growing conditions for forest trees in the Territories. Soils are of glacial origin and of considerable depth, and are usually well drained. Aspen and white spruce are the typical trees, and these are accompanied by all the other species found in the region.

The Northern Coniferous Section occupies a small triangle immediately east of Fort Smith with its base on the northern Alberta boundary. Soils are shallow and drainage is poor. Black spruce is the principal tree species, and it is sometimes found in mixture with jack pine, and with tamarack in the lower and wetter areas.

The Mackenzie Lowlands Section is the most important forest area of the Territories. As its name implies, it occupies the low-lying plains in the basin of the Mackenzie River and embraces the lower portions of the Liard, Peel, and Great Bear Rivers. The soil is of glacial, alluvial, and lacustrine origin, and is generally of good depth. Although the sub-soil is never free from frost, trees grow to a fairly good size. White spruce, the poplars, and birch are all well represented; black spruce and tamarack occupy the swamps and jack pine is found in the sandy areas.

The Northern Transition Section lies north and east of a line passing through the mouth of the Mackenzie River to Great Bear and Great Slave Lakes. Unfavourable climatic conditions, together with thin soils and poor drainage, restrict the stunted growth to the most favourable areas in valleys and along the banks of the streams.

Forest Protection

As the fur trade has been and will continue to be the main support of the Indian population, and as forest-dwelling animals supply the Indians with meat, it is felt that one of the greatest values of the forests of the Northwest Territories lies in the habitat which they provide for game and fur-bearing animals.

During the ten-year period ended 1946, serious fires destroyed many valuable forested areas in Mackenzie District which formerly constituted the better type of wildlife sanctuaries. The decline in the fur yield in recent years can be attributed in part to the destruction by fire of the natural cover of fur-bearers. The reduction in the beaver and marten population, which relies upon the forest for protection, has been most marked, and it has been necessary to prohibit the hunting and trapping of these animals by the natives in districts where wildlife formerly was abundant.

Early in 1946, a Forest and Wildlife Service was established to deal with matters relating to the conservation of these natural resources. This organization is headed by a Superintendent of Forest and Wildlife Management resident at Fort Smith. He is assisted by a staff consisting of a mammalogist, a forest engineer, and approximately twenty park wardens. In the Mackenzie River Valley, wardens are occupying well-equipped stations at Yellowknife, Fort Resolution, Fort Simpson, Fort Norman, and Aklavik. These field officers are equipped with boats and modern fire-fighting equipment, enabling them to take prompt action in the case of fires occurring in their

respective districts. At the conclusion of the fire-hazard season, the wardens are employed in making patrols and investigations for the supervision and development of the wildlife resources.

During the summer of 1947, especially designed boats operated by experienced fire-fighting crews were engaged in making patrols of the Mackenzie River, Liard River, and Slave River systems, including Great Slave Lake area, in the interests of forest protection. The Superintendent of Forest and Wildlife Management used a light reconnaissance plane to patrol the inland areas for the purpose of spotting fires. A larger plane was available to transport fire-suppression crews in emergency situations.

Satisfactory estimates of the areas and volumes of the various types in the Territories are lacking, but more definite information becomes available as the area covered by aerial photographs is extended. It is already known that the forests are not of sufficient present value to justify large expenditures in mapping and describing them, but air photographs taken from time to time for other purposes will give the information needed for their administration.

FAUNA

Land Mammals

THE NUMBER OF SPECIES of mammals in the Northwest Territories is not great, but some of those which occur are often present in large numbers. Six species are white for part or all of the year. These are the polar bear, Arctic fox, Arctic (polar) wolf, weasel, Arctic hare, and the collared lemming. A striking feature of animal life in the north is periodicity in numbers. The list of species whose numbers fluctuate from extreme scarcity to great abundance at regular intervals contains most of the smaller mammals, including the Arctic fox, the most important fur-bearing animal in Arctic Canada, and the lynx. In the following paragraphs are listed some of the more prevalent species.

Musk-ox — One of the most interesting mammals is the Barren Ground Musk-ox, *Ovibos moschatus moschatus* (Zimmerman). In fairly recent times, it was found all over the Barren Grounds west of Hudson Bay and on all the Arctic Islands except those of Hudson Bay, Baffin and Bylot Islands, and the Ringnes group. There are now only scattered herds of musk-oxen on the mainland, the largest being in the Thelon Game Sanctuary. There are also herds on certain Arctic Islands, including Melville and Ellesmere Islands. The killing of musk-oxen is forbidden by law.

Caribou — The most important land mammal from the point of view of the natives is the Barren Ground Caribou, *Rangifer arcticus arcticus* (Richardson). It provides them with food and its skin excels all other materials for making clothing and sleeping robes. The largest herds of caribou are found on the mainland, where groups often numbering many thousands are encountered in migrations from one seasonal range to another. The habitat of the Stone Caribou, *Rangifer arcticus stonei* Allen, is west of the lower Mackenzie River. Western Woodland Caribou, *Rangifer caribou sylvestris* (Richardson) is found in small numbers in the wooded districts from northern Manitoba to Anderson River, overlapping slightly the winter range of the Barren Ground Caribou.

Moose, *Alces americana americana* (Clinton), is fairly plentiful in certain sections and ranges north to the limit of trees. The animal is of importance to the Indians for food and clothing.

Mule Deer, *Odocoileus hemionus hemionus* (Rafinesque), is found in the southern portion of Mackenzie District.

Wood Bison, *Bison bison athabascæ* Rhoads, is restricted to Wood Buffalo Park which is partly in Alberta and partly in the Northwest Territories. More than 6,000 Plains Bison were shipped to this area from Buffalo National Park, Alberta, during 1923–27.

Dall's Sheep, *Ovis dalli dalli* (Nelson), nearly pure white, is found in the mountains west of the Mackenzie River.

Columbian Mountain Goat, *Oreamnos americanus columbiæ* Hollister, occurs in the Nahanni region of the Mackenzie Mountains, southwestern Mackenzie District.

Black Bear, *Euarctos americanus americanus* Pallas, is fairly common in the southern part of the wooded region of the Territories.

Grizzly Bear — Several species of the Barren Ground grizzly bear group occur in Mackenzie District. These include Anderson's Grizzly, *Ursus andersoni* Merriam; Richardson's Barren Ground Bear, *Ursus richardsoni* Swainson; and Mackenzie Delta Grizzly, *Ursus internationalis russelli* Merriam.

Polar Bear, *Thalarctos maritimus maritimus* (Phipps), is found about the coasts of the circumpolar regions, and sometimes wanders far out on the ice. It is so much at home in the water that if it were classified according to habits it would be discussed under Sea Mammals, along with the seals on which it feeds. Its numbers vary greatly in different parts of the Canadian Arctic, and in some localities it is common enough to be of real importance to the Eskimos as a source of food and clothing.

Wolf, *Canis lupus* is common throughout northern Canada. Six distinct sub-species have been identified in the Northwest Territories, including the Northern Timber Wolf, *Canis lupus occidentalis* Richardson; Mackenzie Tundra Wolf, *Canis lupus mackenzii* Anderson; and Keewatin Tundra Wolf, *Canis lupus hudsonicus* Goldman.

Coyote — The Northwestern Coyote, *Canis latrans incolatus* Hall, occurs in the Mackenzie District as far north as the Mackenzie delta.

Arctic Fox — The fur industry of the Arctic depends on the Arctic Fox, *Alopex lagopus innuitus* (Merriam). Under this name are included both white and blue fox, which are merely colour phases of the same species. In Arctic Canada, the blue fox is comparatively rare. As has already been mentioned, the number of Arctic Fox, and consequently the catch, varies over a period of about four years. Investigation has revealed that the actual cause of the cycle in fox is a similar cycle in the lemming, on which the fox feeds.

The **Lemming** is a rodent, resembling a large, chunky field mouse. Two species prevalent in the Canadian Arctic are the Brown or Back's Lemming, *Lemmus trimucronatus trimucronatus* (Richardson), and the Greenland Varying Lemming, *Dicrostonyx grœnlandicus grœnlandicus* (Traill). These creatures can increase in two or three seasons from scarcity to incredible numbers.

Among other fur-bearing mammals which occur in the Territories are the beaver, muskrat, mink, marten, lynx, fisher, weasel, wolverine, skunk, and various phases of the red fox. Hares of various species form an important food supply for natives and for some animals. A number of other mammals, including species of squirrel, mouse, and shrew, are also found.

Sea Mammals

All the sea mammals play an important part in the economy of the inhabitants of the Arctic regions. They are essential parts of the food source of the Eskimos, and from some of them are obtained material for clothing and other articles. Some are also of commercial value to the white traders. The seals, of which there are several varieties, are perhaps of the greatest economic importance to the Eskimos. From them are obtained food, clothing, dog food, and material for implements. The following descriptive notes deal only with the more important species of marine mammals.

The **Arctic Ringed Seal,** *Phoca hispida hispida* Schreber, also called the Rough or Jar Seal, is the common seal of the coasts of both Western and Eastern Arctic regions. It is the chief source of food of some of the Eskimos. The haired skin is used for making waterproof boots, and the dehaired skin for other garments, especially when caribou are scarce. The skins are also purchased by the traders, but do not bring a large price. The young are born in an opening in the snow beside the breathing hole in the ice, and are covered with a white woolly fur.

The **Bearded Seal, Ground Seal or Square-flipper,** *Erignathus barbatus barbatus* (Erxleben), is a circumpolar species which is fairly common in the Eastern Arctic, and also occurs in the Western Arctic, but is not common west of Darnley Bay. It is most plentiful in the vicinity of Dolphin and Union Strait, south of Victoria Island. Owing to its large size (up to 800 pounds) it is much prized by the Eskimos, as it provides a great amount of meat and blubber. Its heavy hide is used for boot soles and for covering the large skin boats, and is cut into heavy line which is used for dog traces, harpoon lines, and lashings of any kind. It lives mostly on crustaceans and mollusks.

The **Atlantic Walrus,** *Odobenus rosmarus* (Linnæus), has become scarce and is now rarely found in the Atlantic Ocean south of Hudson Strait, although at one time it ranged much farther south. In Hudson Bay, it is found as far south as the Belcher Islands. Apparently the western limit of range of the Atlantic Walrus in the south is Fury and Hecla Strait, and in the north the upper part of Prince Regent Inlet as far south as Bellot Strait and the middle of Barrow Strait, south of Cornwallis Island.

The **Pacific Walrus,** *Odobenus divergens* (Illiger), seldom goes east of Point Barrow, although it was formerly plentiful as far as Cape Bathurst. The killing of walrus, except for food, is prohibited, and only Eskimos may kill them without a licence. The export of walrus tusks or ivory, except in the shape of manufactured articles, is legal only by permit from the Minister of Fisheries.

Bowhead or Greenland Whale, *Balæna mysticetus* Linnæus, was at one time very plentiful in Baffin Bay and in Hudson Bay and Hudson Strait. Great numbers of whales were killed during the whaling season, and they soon became so scarce that it was unprofitable to hunt them, especially after the drop in the price of whale-bone and the introduction of mineral oils, which replace whale oil as a lubricant. Before the introduction of firearms, the natives of some localities captured the Bowhead by lancing it from their skin boats; they used the flesh for food, and the oil for food and fuel. The bones were used for making implements.

White Whale, *Delphinapterus leucas* (Pallas), is found in arctic and sub-arctic seas as far north as latitude 74 degrees, and is occasionally found as far south as Cape Cod, Massachusetts. These whales are much prized by the Eskimos, especially when they enter bays and estuaries in large schools.

Narwhal, *Monodon monoceros* Linnæus, found usually in the more northern waters, preferring the proximity of the ice, so that, in summer, its range is more northerly than that of the white whale. These whales are especially abundant at Pond Inlet, and in the icy waters of Foxe Channel and Frozen Strait, and were at one time abundant in Cumberland Sound and along Hudson Strait. Their long, spirally twisted horns, which are overgrown incisors, often attain a length of 8 feet and a weight of 14 pounds.

Birds

Although some systematic work has been done by Canadian Government expeditions, and although early explorers and others have brought back much information of value to ornithologists, relatively little is yet known of the bird life of the Arctic regions. With the establishment of new settlements and posts, however, there should be increased opportunities to make systematic studies of this form of life.

The birds of the Western Arctic and sub-Arctic region of Canada are somewhat different from those of the Eastern Arctic, owing to the existence of wooded areas in the former region. In the lower part of the Mackenzie River basin, bird fauna is essentially Eastern as far as the Arctic Coast at 138 degrees west longitude. As the valley is sheltered, it carries the range of many species far north of their limits farther east. The robin, yellow warbler, and water-thrush are found as far north as the lower islands of the Mackenzie delta, while western influences may be seen in the delta in species like the varied thrush and Say's phœbe. Other typical birds of the wooded area include the white-crowned sparrow, Canada jay, and spruce grouse. The unwooded area has such Arctic species as the willow and rock ptarmigan, snow bunting, and lapland longspur. On the border between woods and tundra, the tree sparrow and Harris's sparrow find their nesting ground.

Geese and fresh-water ducks breed in the marshes and lakes, particularly in the Mackenzie Valley, and are of some importance as food for the residents. They also contribute migratory fowl for the south. The game ducks breed mostly in the delta and in the overflow flats along the Athabaska-Slave-Mackenzie Rivers system. The lakes of the Precambrian area are as a rule deep and clear, and, as they provide little feed for ducks, few breed there to augment the southern flights for autumn. The only common duck in the tundra region is the old squaw, which breeds in the interior north of the timber-line. Many Canada geese and lesser snow geese breed east of the Mackenzie delta, on Banks Island, and farther east. The white-fronted goose is of general distribution, but is not common anywhere along the coast. Whistling swans are fairly common east of the Mackenzie River, especially in the region near Langton Bay. Black brant breed near the coast east of the Mackenzie in the vicinity of Cape Bathurst. Farther east, the black brant is replaced by the common or white-breasted brant. Blue geese nest only in the Canadian Arctic, and their principal nesting ground, which was discovered in 1929, is on the west coast of Baffin Island. Two other nesting areas have been discovered, one on Southampton Island and the other on the Perry River. Ross's goose is known to nest on the Perry River, which drains into Queen Maud Gulf. Snow geese nest widely on the Arctic tundra, the larger sub-species, the greater snow goose, nesting on northern Baffin Island and to the westward.

Compared with those of the Eastern Arctic, the coasts of the Western Arctic are generally low and flat, and they provide a more favourable area for shorebirds and tundra plain species. The absence of puffins, auks, and auklets in the Western Arctic, and in fact, east of Point Barrow, is due

mainly to the physical character of the coasts. These birds are abundant in western Alaska as far as Cape Lisburne, where the rocky cliffs preferred by the birds as nesting places terminate, and the coastal plains appear.

Most of the migrants on the main Arctic Coast move from east to west instead of north and south. The sea-ducks, gulls, jægers, and many of the shore birds come from the Bering Sea and the Pacific Ocean. Some of them come around the far northwest corner of Alaska, reaching the eastern limit of their range as far east as Banks Island, Melville Island, and Coronation Gulf. East of Franklin Bay, the country for the most part is barren or rocky, and the shores of Amundsen Gulf, Dolphin and Union Strait, and a large part of Coronation Gulf show a surprising scarcity of birds. The migrations follow regular narrow and uniform routes from year to year. In the early spring, they follow leads of open water along the edge of the floe-ice, but later they follow the coast from one headland to another straight across the ice of the bays. At Cape Bathurst and at Baillie Island post on the peninsula between Liverpool and Franklin Bays, there may be seen during some seasons an almost continuous migration of eiders, starting before the season of open water and lasting until the autumn freeze-up.

The willow ptarmigan and the smaller rock ptarmigan are the most important birds in the economy of the northland. They are widely distributed, reaching the most northerly islands, and are prolific breeders. They form an important part of the food of the fur-bearing carnivores, and provide the only feathered game available for human food in an emergency. Except for minor fluctuations, the ptarmigan will probably maintain their numbers for many years, as vast areas are still unhunted.

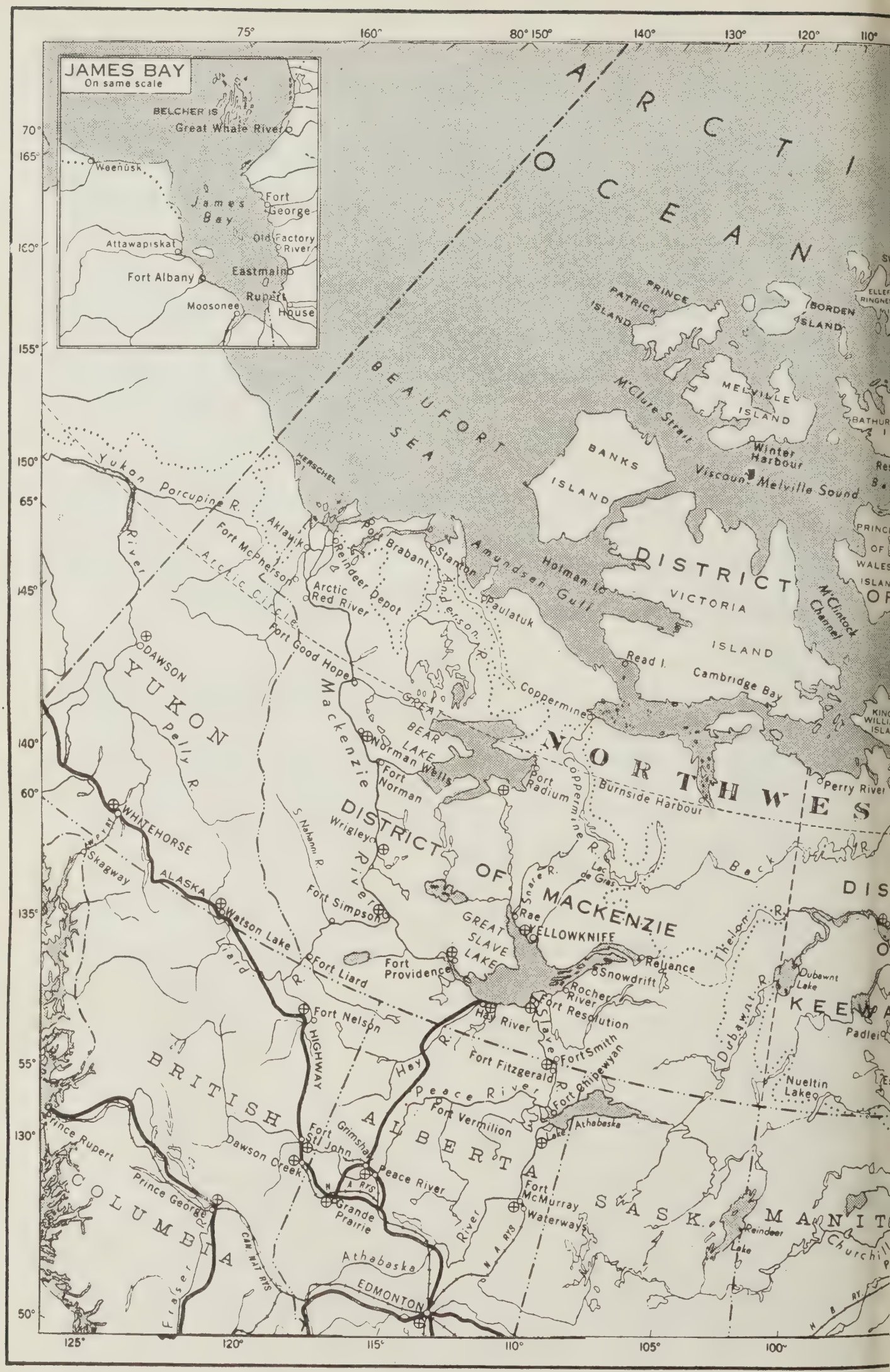
Fish

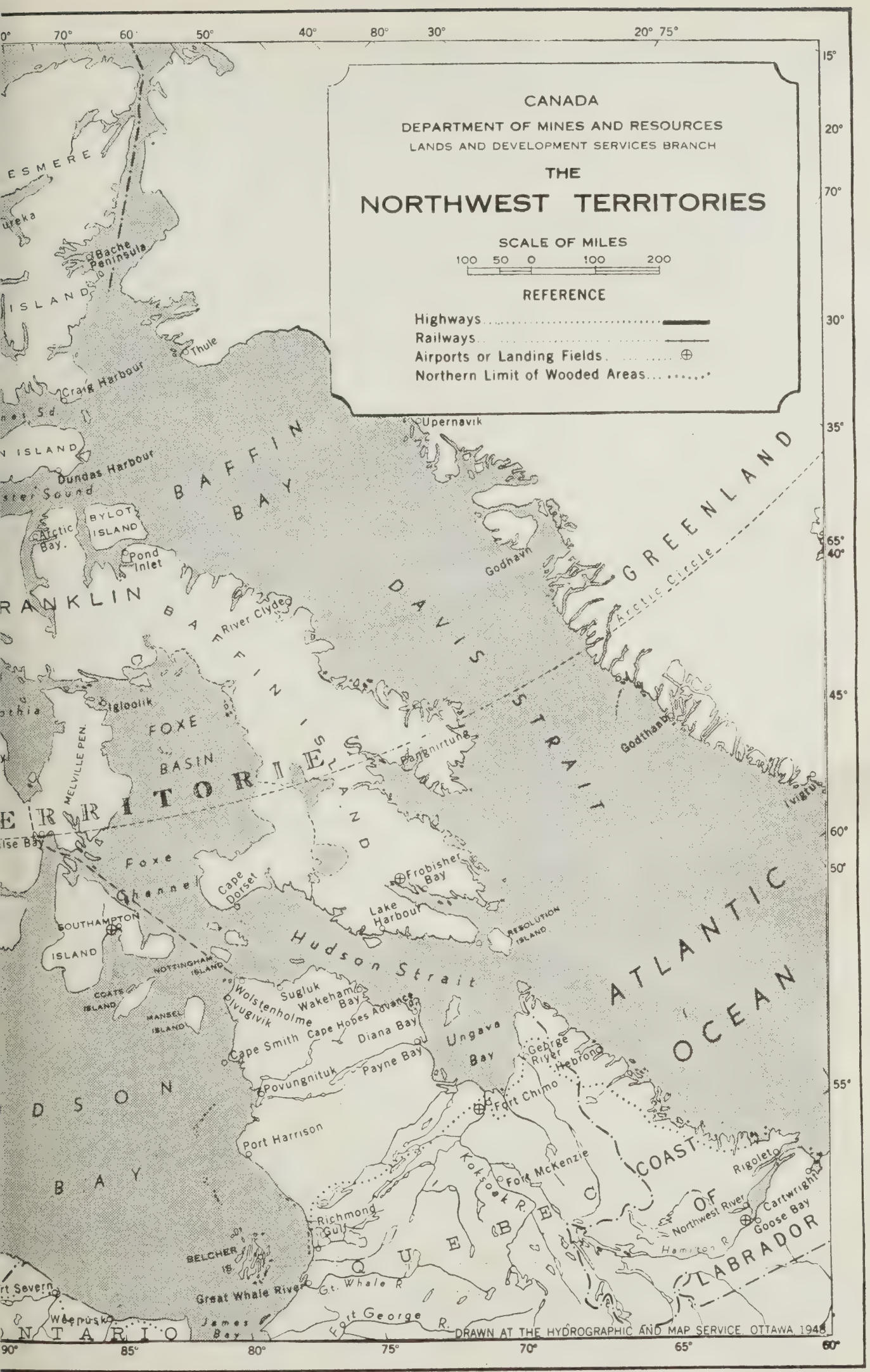
Fish of several varieties are abundant in many parts of the Northwest Territories and are of economic importance. For the most part, however, it has not been considered commercially feasible to export them, owing to the distances from the fish consuming centres. Because of peculiar water conditions and of a deficiency of fish food, the main portion of Hudson Bay is not productive of fish, and it is questionable whether, over a period of several years, its coastal rivers and shore fisheries can do much more than support the needs of the local population.

The scarcity of fish in Hudson Bay was noticed as far back as 1771, when the Hudson's Bay Company investigated the bay's resources. In 1931, the Department of Fisheries made a study of the deep sea fisheries of the bay, using steam trawlers and drag nets, but after three weeks of effort, during which more than 200 miles of sea bottom were covered, no commercial fish were taken. During the same season, the Department investigated the coastal fisheries north of Churchill. Competent fishermen, using nets, covered the area, but obtained only about 6,000 pounds of fish during the summer and autumn seasons, the chief varieties taken being Arctic char and ciscoes.

Following are descriptive notes on the chief varieties of fish found in the Northwest Territories and in waters bordering the Territories.

Arctic Char, also called sea trout or salmon, is perhaps the most important food fish of the Arctic. This species occurs in great numbers in certain seasons of the year and is found in both fresh and salt water, chiefly near the mouths of rivers in the latter case. These fishes are plentiful in parts of the Eastern Arctic, principally the Baffin Island area, the rivers of Melville Peninsula, and the northern parts of Hudson Bay. They also frequent the coastal waters of the northwestern mainland of the Northwest Territories.


JAMES BAY
On same scale
BELCHER IS
Great Whale River
Weenusk
James Bay
Fort George
Old Factory River
Attawapiskat
Fort Albany
Eastmain
Moosonee
Rupert House
ARCTIC OCEAN
BEAUFORT SEA
PRINCE PATRICK ISLAND
BORDEN ISLAND
MELVILLE ISLAND
McClure Strait
BANKS ISLAND
Winter Harbour
Viscount Melville Sound
HERSCHEL
Yukon
Porcupine R.
Aklavik
Fort McPherson
Arctic Red River
Reindeer Depot
Port Brabant
Stanton
Anderson R.
Amundsen Gulf
Holman Is.
Paulatuk
DISTRICT
VICTORIA
ISLAND
Read I.
Cambridge Bay
McClintock Channel
Arctic Circle
Fort Good Hope
Coppermine
DAWSON
YUKON
Pelly R.
Mackenzie River
GREAT BEAR LAKE
Norman Wells
Fort Norman
Port Radium
Coppermine R.
Burnside Harbour
Perry River
NORTHWES
WHITEHORSE
White R.
Skagway
ALASKA
S. Nahanni R.
Wrigley
DISTRICT OF MACKENZIE
Watson Lake
Fort Simpson
Rae
YELLOWKNIFE
Lac de Gras
Back R.
Thelon R.
Liard R.
Fort Liard
GREAT SLAVE LAKE
Fort Providence
Reliance
Snowdrift
Rocher River
Fort Resolution
Dubawnt Lake
Dubawnt R.
KEEWA
Padlei
Fort Nelson
HIGHWAY
Hay River
Hay R.
Fort Fitzgerald
Fort Smith
Fort Chipewyan
Nueltin Lake
BRITISH
Peace River
Fort Vermilion
Athabaska L.
Prince Rupert
Fort St John
Grimshaw
Dawson Creek
Peace River
ALBERTA
COLUMBIA
Prince George
Grande Prairie
Fort McMurray
Waterways
SASK.
MANITO
Reindeer Lake
Churchill
CAN NAT RYS
Athabaska
EDMONTON
Fraser R.
N A RYS
75°
160°
80° 150°
140°
130°
120°
110°
70°
165°
160°
155°
150°
65°
145°
140°
60°
135°
55°
130°
125°
120°
115°
110°
105°
100°
50°


CANADA
DEPARTMENT OF MINES AND RESOURCES
LANDS AND DEVELOPMENT SERVICES BRANCH
THE
NORTHWEST TERRITORIES
SCALE OF MILES
100 50 0 100 200
REFERENCE
Highways
Railways
Airports or Landing Fields
Northern Limit of Wooded Areas
DRAWN AT THE HYDROGRAPHIC AND MAP SERVICE, OTTAWA 1948
BAFFIN BAY
DAVIS STRAIT
GREENLAND
FOXE BASIN
Foxe Channel
Hudson Strait
ATLANTIC OCEAN
BAY
ONTARIO
QUEBEC
LABRADOR
COAST OF
ISLAND
Arctic Circle
Upernavik
Godhavn
Godthaab
Ivigtut
Igloolik
Frobisher Bay
Cape Dorset
Lake Harbour
Resolution Island
Southampton Island
Nottingham Island
Coats Island
Mansel Island
Wolstenholme
Sugluk
Wakeham Bay
Cape Smith
Cape Hopes Advance
Diana Bay
Ungava Bay
George River
Hebron
Povungnituk
Payne Bay
Fort Chimo
Port Harrison
Richmond Gulf
Koksoak R.
Fort McKenzie
Rigolet
Northwest River
Goose Bay
Cartwright
Hamilton R.
Belcher Is.
Great Whale River
Great Whale R.
Fort George R.
James Bay
Weepuska
Port Severn
Craig Harbour
Dundas Harbour
Arctic Bay
Bylot Island
Pond Inlet
Thule
Eureka
Bache Peninsula
Ellesmere Island
Melville Pen.
River Clyde
Franklin Bay
90°
85°
80°
75°
70°
65°
60°

Whitefish of one or more species is found in almost every lake or stream of the mainland. Many of the early explorers depended on it to a large extent for food and it still plays an important part in the food economy of sparsely settled regions. It makes an excellent dog food for winter travel.

Round Fish, Frost Fish, is a species of whitefish of which little is known as to abundance or distribution in the Territories.

Arctic Cod is widely distributed in Hudson Bay and among some of the islands of the District of Franklin.

Ordinary or Newfoundland Cod has been taken at Port Burwell at the entrance to Hudson Strait. Cod weighing up to 40 pounds are taken in the tidal lagoons in Frobisher Bay.

Tom Cod is found in Western Arctic waters as far east as Coronation Gulf and is abundant in some localities. These cod are taken through the ice with hooks and are also caught by the Copper Eskimos with a large barbless hook holding small bone bangles. Other members of the cod family are occasionally caught in the Eastern Arctic.

Halibut or Greenland Halibut is found in the Eastern Arctic, especially on the Greenland side.

Flounder, a Pacific species, is found east of Coronation Gulf.

Inconnu or Conny inhabits most of the large rivers of the Northwest Territories west of Anderson River, ascending them as far as the first rapids. These fishes are of low vitality and are sluggish, which probably explains why they are not found above any heavy rapids in the streams they frequent. They average from 8 to 20 pounds. In the Mackenzie River system, the inconnu probably winter at the Mackenzie delta and in Great Slave Lake. They ascend the rivers about June and return in October. They spawn at Fort Smith from about mid-September to October and are found in great numbers in the eddies below the rapids. At the mouth of the Mackenzie River, they are caught by the Eskimos through the ice by means of hook and line baited with an ivory lure. The larger Connies are not palatable but the smaller ones, when dried and smoked, are suitable for human consumption. Connies make excellent dog food.

Grayling, or Bluefish as it is called in the Mackenzie region, is widely distributed but is found only in clear lakes and rivers. It is of little value as food or game fish.

Suckers are found in most of the waters of the Mackenzie delta and in the rivers of the Mackenzie Valley. They are used for dog food when other fish are not obtainable.

Cisco, Tullibee, Lake Herring is found in the brackish portions of Hudson and James Bays and also along the Arctic Coast and in the Arctic Red River, where it is abundant in the spawning season in September. Several species occur in the mainland portions of the Northwest Territories.

Great Bear Lake Herring is a common food fish in the Western Arctic along the coast as far as east of Coronation Gulf. It is caught in nets during the summer and by hooks during the ice season.

California Herring is abundant in the waters about Cape Bathurst in late August, where it is taken in nets in large numbers.

Lake Trout is a very excellent food fish and is found in most of the large inland lakes in Mackenzie and Franklin Districts, especially in deep waters. These trout occasionally reach a weight of 60 pounds.

Pike or Jackfish is found along the north mainland coast from Alaska to Cape Bathurst in the rivers and inland lakes and is especially abundant in the region of the Mackenzie delta. Pike weigh as much as 35 pounds, but average from 5 to 15 pounds. They frequent clear pools at the foot of falls and rapids and the deeper lakes.

Smelt is common about the Arctic Red River and is an important food in that locality.

Burbot, Ling, Loche is found in most of the fresh and brackish waters of Mackenzie and Keewatin Districts, but is not abundant. It also occurs along the coasts of James Bay.

Other fish of lesser importance found in the waters of the Northwest Territories include goldeye, several members of the sculpin family, several varieties of ray, dog fish in Davis Strait, stickleback, and the Greenland or sleeping shark.

GEOLOGY*

THE NORTHWEST TERRITORIES are made up of parts of four of the six physiographic divisions of Canada. The islands to the north form the Arctic Archipelago. On the west, the Mackenzie Mountains are the northeastern extension of the Great Cordilleran region which makes up most of British Columbia and Yukon Territory. The belt bordering the Mackenzie River is the northern extension of the Interior Plains of Central Canada. East of this belt and extending over to Hudson Bay is a great area that forms part of the Canadian Precambrian Shield.

Canadian Shield

The Canadian Shield portion of the Territories is a region of comparatively low relief, rising gradually from the Arctic Ocean on the north and from Hudson Bay on the east to elevations of about 1,500 feet in its central part east of Great Bear and Great Slave Lakes. The area is hummocky, consisting of ridges and hills separated by depressions occupied by lakes or muskegs. The many lakes are of all sizes and shapes, and have irregular shorelines and many islands. For most of the area the local relief is rarely more than 100 feet, but in places east of Great Bear Lake it is more than 1,000 feet.

The low relief of the region is the result of long continued erosion in late Precambrian time, which levelled the mountain belts that must have existed in earlier times. During the Palæozoic and Mesozoic eras this region of low relief was probably partly covered by seas that advanced over its surface and later retreated. The sediments that accumulated in these seas were largely swept away by later erosion when, during the Tertiary period, the region stood above the sea.

The oldest known rocks in the Northwest Territories are Archæan (early Precambrian) volcanic flows and sediments. The volcanic rocks, which in general are older than the more widespread sedimentary rocks, are mainly altered basic lava flows or greenstones, locally altered to chlorite or hornblende schists. The sedimentary rocks for the most part are well bedded greywackes and slates that have been altered over large areas to knotted quartz-mica schist and hornfels by the intrusion of large granite batholiths. Both the volcanic and sedimentary rocks have undergone

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* Prepared by A. W. Jolliffe and revised by J. F. Henderson, Geological Survey of Canada, Mines, Forests, and Scientific Services Branch, Department of Mines and Resources, Ottawa.

several periods of folding and faulting and are now steeply inclined or overturned. These Early Precambrian rocks have been called the Yellowknife group and the Point Lake-Wilson Island group north of Great Slave Lake, and the Tazin series south of this lake.

During Proterozoic or later Precambrian time, there were at least two periods during which great thicknesses of sedimentary and volcanic rocks accumulated in several widely separated areas. Rocks of the older period have been recognized on the north shore of Lake Athabaska, in the east arm of Great Slave Lake, near the Arctic Coast, and in several intervening areas. On the north shore of Lake Athabaska, white and red quartzite of the Beaverlodge series overlies Archæan sediments of the Tazin series and granitic rocks, but is itself cut by granite, gabbro, and norite. Between Athabaska and Great Slave Lakes, the Nonacho series of conglomerate, slate, greywacke, arkose, and quartzite occupies an area about 100 miles long and up to 25 miles wide. The area is completely enclosed by granitic rocks, in part older, in part younger, than the Nonacho sediments. Along the east arm of Great Slave Lake, a synclinorium about 150 miles long consists of conglomerate, arkose, sandstones, quartzite, shale, slate, oolitic iron formation, dolomite, breccia, basalt, andesite, trachyte, rhyolite, porphyry, and tuff. Two or more series of strata may be represented in this assemblage, which is known as the Great Slave group. It rests unconformably on granite, and is itself intruded by syenite and diorite.

Between Great Slave and Great Bear Lakes, several areas are underlain by quartzite, arkose, conglomerate, slate, argillite, greywacke, dolomite, and limestone, with minor flows and basic intrusions. These rocks, which resemble the lower part of the Great Slave group, have been called the Snare group. Pre-Snare and post-Snare granitic rocks occur in the vicinity. Along the east coast of Great Bear Lake and to the east is the Echo Bay group of sediments, bedded tuffs, lavas, and intrusive and extrusive porphyries. These rocks are overlain by the Cameron Bay group comprising conglomerate and red sandstone. Along the Arctic Coast, between Parry Peninsula and Bathurst Inlet, three formations of probable early Proterozoic age rest on Archæan granite. They include the Epworth dolomite, the Kanuyakcalcareous tuff and tuff-conglomerate, and the Goulburn quartzite.

Late Proterozoic time was marked by the accumulation of flows and clastic sediments over large areas. These include the Coppermine River series of the Arctic region, the Et-then series of the Great Slave Lake region, and the Athabaska series of the Athabaska-Dubawnt Rivers region. The Coppermine River series consists largely of basaltic flows interbanded with some sandstone and shale and cut by diabase sills; the Et-then series of conglomerate, sandstone, and quartzite resting unconformably on members of the Great Slave group; and the Athabaska series of white, buff, and reddish sandstone, arkose, and conglomerate.

The last great event in the geological history of the region was the spread of a continental ice mass in Pleistocene times. This had its gathering ground west of Hudson Bay, from which centre it advanced in all directions. Erratics and morainal material left by the ice are scattered over the entire region.

Continuous mining operations commenced in the Shield part of the Northwest Territories in 1933. Pitchblende from the Great Bear Lake area and gold from the Yellowknife district are the main minerals produced. Data on pitchblende production are not available but the annual gold production in 1942 reached $3,826,000. Due to the war and consequent labour shortage, gold production fell to $333,218 in 1945. It was increasing

rapidly in 1947, however, and should exceed its former peak within a few years. Other minerals recovered in small quantities, mainly as by-products, include silver, copper, and lead. A small amount of tungsten was produced during the war. The more important known occurrences of minerals of possible economic interest are summarized below.

Gold occurrences are widespread in the region extending northwestwards for 200 miles from the east arm of Great Slave Lake. They are also known along and near the west coast of Hudson Bay — on Chesterfield Inlet, Wager Bay, Term Point, and the Ferguson River. Radium and silver minerals are found at a number of places east of Great Bear Lake and to the south along the Camsell and Marian Rivers. Copper occurrences are common around Coronation Gulf and south to Great Bear Lake. A copper-nickel sulphide body containing platinum group metals occurs on Rankin Inlet on the west side of Hudson Bay. Cobalt and nickel are associated with the Great Bear Lake ores and are also found in the area adjacent to the east arm of Great Slave Lake. Low-grade iron ores are found on islands in Great Slave Lake. Lead minerals occur on the Arctic Coast, and in the Taltson River and Pine Point areas south of Great Slave Lake. Lead-zinc copper replacement bodies are found in the Yellowknife-Beaulieu region near Homer and Tumpline Lakes. Chromite has been reported from Melville Peninsula and from the Coppermine River area. Molybdenite occurs in the Yellowknife district. Tungsten has been recovered from the gold ores on Outpost Islands, Great Slave Lake, as well as from one of the hundreds of scheelite deposits in the Yellowknife-Beaulieu region. Tin-bearing minerals have likewise been found in both of these districts. Tantalum, beryllium, and lithium minerals occur in pegmatites in the Yellowknife-Beaulieu region. Fluorite is reported from Baker Lake and from Snare River. Semi-precious gems, including sapphire, dichroite, chiastolite, jade, and lazulite have been found along and near the western margin of the Shield.

Cordilleran Region

An area of some 30,000 square miles of the Northwest Territories, west of the Mackenzie River and between the Peel River on the north and the Liard River on the south, is part of the great Cordilleran region of Western Canada. The Mackenzie Mountains, forming this region and a part of Yukon Territory, are made up of ranges trending in a northwest direction and ranging in elevation up to over 8,000 feet with a relief, where explored, of 3,000 to 4,500 feet. The drainage of the area is to the Mackenzie, the chief streams being the Arctic Red River, the Carcajou, the Keele (formerly the Gravel), the Root, the North Nahanni, and the South Nahanni, the last of which empties into the Liard. These streams have steep gradients. On the Keele River, where the belt is widest, the high mountains lie about 50 miles from the Mackenzie River, and between them and the Mackenzie lowland is a zone of foot-hills about 3,000 feet in height. Farther south at the "Great Bend" of the Mackenzie near where the latter is joined by the North Nahanni, the mountain front is an abrupt escarpment whose top is 2,000 to 3,000 feet above the valley plain.

The rocks of the range are chiefly sediments of Palæozoic age ranging from Upper Cambrian to Carboniferous. The rocks of the eastern belt are heavily bedded limestones, dolomites, sandstones, and conglomerates. Nahanni Peak, one of the striking mountain features to be seen by the traveller descending the Mackenzie River, is composed of Middle Devonian strata. Lying above the hard limestones are Upper Devonian shales which have a thickness of as much as 2,000 feet, and above these is a limestone zone 800 to 1,100 feet thick. This in turn is succeeded by other shale and

limestone facies from 1,300 to 1,500 feet thick, all of Upper Devonian age. On the North Nahanni, the Middle Devonian rocks form an anticline, with steep dips on the east and more gently inclined beds on the west.

In Pleistocene times, the Mackenzie Mountains were occupied by the northern extension of the Cordilleran ice-sheet which here had a thickness of about 3,000 feet. The higher peaks were not covered.

Not many mineral occurrences have been reported from the Cordilleran part of the Northwest Territories, due in part, at least, to the fact that only very limited exploration and prospecting have been carried on. Iceland spar has been recovered from deposits in the northern part of the mountains; low-grade iron ores are exposed along the Keele (Gravel) River; and placer gold has been found along the Peel, Nahanni, and Liard Rivers.

The Interior Plains

The Mackenzie lowland includes the belt between the Cordilleran region on the west and the Canadian Shield on the east. It begins on the Slave River, embraces the basin at the west end of Great Slave Lake, and continues down to the Arctic Coast. On the Slave River its elevation is about 700 feet, and from there northward the surface slopes gradually to the Arctic Ocean. North of the North Nahanni River, the lowland is divided by the long, narrow ridge of the Franklin Mountains, and consists of a western part varying in width from 20 to 80 miles through which the Mackenzie River flows, and an eastern part occupying all but the east side of the drainage basin of Great Bear Lake. The highest summit is Mount Clark of the Franklin Range, which has an elevation between 3,000 and and 4,000 feet.

The Mount Clark formation consists of red quartzites and sandstones of probable lower Cambrian age. Above these lies the Middle Cambrian Mount Cap formation of grey, green, and red sandstones and shales. These in turn are overlain by a series of red and green shales with gypsum and salt bearing beds of uncertain age lying between Middle Cambrian and Upper Silurian beds. Shale beds of possible Ordovician age are exposed at the base of Mount Kindle east of Wrigley.

Rocks of Ordovician and Silurian age form the base of the Palæozoic section along a considerable part of the eastern edge of the lowland belt, where the Palæozoic sediments overlap the precambrian rocks of the Canadian Shield. On the west side of the north arm of Great Slave Lake, Ordovician sediments form an escarpment which probably continues northward to Great Bear Lake. Silurian limestone and gypsiferous dolomite occur along the Slave River, and silurian strata are also exposed on Lone Mountain near the mouth of the North Nahanni River, in Bear Mountain near Norman, and on Mount St. Charles on the Great Bear River.

The Silurian strata are succeeded unconformably by beds of Devonian age which form the surface rocks over the greater part of the Mackenzie Lowland region. On Great Slave Lake, the Devonian strata have been divided into three formations, in ascending order: the Pine Point limestone, about 100 feet thick; the Presqu'ile dolomite, with an estimated thickness of 200 feet; and the Slave Point limestone, about 160 feet thick. Along the lower Mackenzie, the following formations have been correlated with these respectively; the Hare Indian River shales, over 300 feet thick; The Ramparts limestone, 250 feet thick; and the Beavertail limestone, 350 feet thick. The Ramparts limestone is so named from its excellent exposures in The Ramparts section just above Fort Good Hope.

Sandstones and shales of Cretaceous age cover considerable areas in the Mackenzie Lowland region. They outcrop on the Liard River near the southern border of the Territories, along the Mackenzie north of the Dahadinni River in several disconnected stretches, and along the western shores of Great Bear Lake. The beds are largely of marine origin, but in places some of the lower strata carry coal seams. At the mouth of the Bear River, a basin of partly consolidated Tertiary sands and clay with lignite beds has a length of 30 to 40 miles and a width of from 20 to 30 miles. The beds are of lacustrine origin.

The mineral resources of the Interior Plains include salt, gypsum, the mineral fuels, lead, zinc, and iron. Petroleum valued at nearly one million dollars was produced at Norman Wells between 1932 and 1943, inclusive, and in 1944, under the Canol Project, this field had a peak production of 1,229,310 barrels. Oil seepages have been reported from numerous other places in the Mackenzie River Valley. Lignitic coal occurs near Fort Norman and Aklavik, and on the east coast of Great Bear Lake. Salt and gypsum deposits are widespread throughout the Interior Plains: some deposits have been put to local use. Ferruginous beds outcrop in the Franklin Mountains. Lead and zinc minerals are found in Devonian limestones near Pine Point on the south shore of Great Slave Lake.

Comparatively little is known of the geology of the Arctic Archipelago. Available information suggests that, like the mainland part of the Northwest Territories, a three-fold division into Shield, Plains, and Mountains is warranted. Thus, the southeastern islands are composed chiefly of crystalline rocks of Precambrian age. Northwesterly, these become overlain by nearly flat Palæozoic sandstones and limestones, with successively younger strata, including carboniferous coal seams, generally similar in age and structure to the rocks of the Interior Plains, appearing at the surface. In the extreme northwestern part of the Archipelago, observations at a few widely separated districts suggest the existence of a mountain range, consisting largely of folded and intruded Mesozoic rocks extending southwesterly for nearly a thousand miles from northern Ellesmere Island through the Sverdrup group.

Occurrences of graphite and mica near the southeast coast of Baffin Island have been known for more than 360 years; some mining has been done for both these minerals. Coal has long been mined for local use from a small basin of Tertiary rocks near Pond Inlet on Baffin Island. One hundred miles to the west, platinum, nickel, and silver occurrences have been reported from Admiralty Inlet. Iron ores are found in rocks of Proterozoic age on Belcher and Nastapoka Islands in Hudson Bay; at the latter locality they contain appreciable amounts of manganese.

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THE MINING INDUSTRY

THE PRODUCTION of minerals on a commercial basis in the Northwest Territories is a comparatively recent development, and the value of the annual output is not large when compared with that of older mineral-producing areas of the Dominion. Mining has, however, surpassed in value the fur trade, the only other important industry in the Territories, and, up to the end of 1942, showed a steady increase. Conditions brought about by the war contributed to a decline during the following three years, but, by 1946, mineral production was increasing. Since then a steady improvement, particularly in the Yellowknife gold-field, has been evident.

The occurrence of potentially valuable minerals in the Northwest Territories was first reported by Martin Frobisher, who in 1576 entered a bay in southern Baffin Island which now bears his name. Copper was found by Samuel Hearne near the mouth of the Coppermine River in 1771, and, in 1789, Alexander Mackenzie observed coal seams on the river named for him, but most of the present knowledge of the mineral possibilities of the region has been acquired since 1920. During that year and the four years following, oil in commercial quantities was obtained from wells drilled about 48 miles north of Fort Norman on the Mackenzie River. However, as there was no market for the oil, the wells remained capped for several years.

Interest in the mineral possibilities of the Northwest Territories has resulted mainly from the discovery of radium-bearing and silver ores on the eastern side of Great Bear Lake in 1929 and 1930. The spectacular nature of the discovery—destined to effect a marked reduction in the price of radium—inspired a world wide interest in the region. This interest was intensified by the discovery of gold in the vicinity of the Yellowknife River on the north shore of Great Slave Lake in 1933-34, resulting in the development of a field whose potentialities have not yet been fully determined.

Petroleum

Seepages of petroleum in Mackenzie District were known to early explorers, and the first report of the Geological Survey of Canada on the Mackenzie River region, covering field-work undertaken in 1887-88, noted indications of the presence of petroleum. In 1914, three petroleum claims were staked along the Mackenzie River near Bosworth Creek, about 48 miles north of Fort Norman. These claims later were acquired by the Northwest Company, a subsidiary of Imperial Oil Limited, and, in 1919, drilling equipment was shipped to the site, now known as Norman Wells. In 1920, the first well was drilled and oil in commercial quantity encountered. Three "wildcat" wells drilled by the Northwest Company and one by the Fort Norman Oil Company between 1921 and 1924, within a 45-mile radius of Discovery Well No. 1, failed to produce oil in commercial quantity, but another producer was brought in by the Northwest Company near Discovery Well in 1925.

A small still, capable of producing gasoline and diesel fuel, was installed by the Northwest Company in 1921, but there was little demand for these products until the mining of pitchblende was commenced at Great Bear Lake in 1933. The development of gold mines in the Yellowknife area greatly increased the demand for petroleum products, and Imperial Oil Limited drilled and brought in two more wells in 1939 and 1940. The productive capacity of the four wells was then about 450 barrels of oil daily. A small refinery erected in 1939 came into operation in 1940, and its products now include aviation and motor gasolines, light and heavy diesel oils, and fuel oil. In 1943, the capacity of the refinery was increased from 840 to 1,100 barrels of crude petroleum per day.

Following the outbreak of war between the United States and Japan, the petroleum industry at Norman Wells underwent a tremendous expansion. The demand for an increased supply of petroleum products for the use of the United States Army in Alaska prompted Canada and the United States to enter an agreement whereby the latter would undertake a development known as the "Canol Project." Under the terms of the agreement, the project involved an extensive drilling program to determine the extent and capacity of the oil producing area in the vicinity of Norman Wells; construction of a pipeline, with a capacity of 3,000 barrels daily, from Norman Wells to Whitehorse, Yukon Territory; and the erection of a refinery at Whitehorse.

Imperial Oil Limited, which, as the Northwest Company, had been pioneering the district since 1919, was appointed agent for the United States Government and awarded a contract for drilling and geological exploration. Drilling was commenced in 1942 and continued through 1943 and 1944 into 1945. Construction and testing of the pipeline were completed by the end of March, 1944, and the refinery at Whitehorse was opened in April of the same year. Deliveries of oil by pipeline to the refinery eventually reached a maximum of 4,000 barrels daily. Drilling operations were terminated on March 8, 1945, by order of the United States Government. The pipeline and the refinery at Whitehorse ceased operations about April 1, 1945, and the contract with Imperial Oil Limited was officially terminated in May, 1945.

During the period 1942–45 in which the Canol Project operated, 67 new wells were drilled, of which 60 found oil in commercial quantity. These wells outlined a field of more than 4,000 acres in extent, with an estimated recoverable reserve of 36,250,000 barrels of petroleum. Prior to 1942, the production of the field totalled 118,895 barrels. Production during the life of the Canol Project was 1,858,447 barrels. The total production of the Norman Wells field to December 31, 1947, was 2,463,780 barrels. Of this quantity, 231,844 barrels were obtained in 1947.

The Canol Project was a military enterprise undertaken for North Pacific defence. When its objectives had been achieved, economic considerations forced its abandonment. The closing down of the pipeline shut off the principal market for crude petroleum output of the Norman Wells field, and many of the wells have since been capped or plugged. The remainder will more than meet the petroleum requirements of the Mackenzie District for many years to come. The greater part of the crude oil now processed at Norman Wells is shipped for consumption at the Eldorado Mine on Great Bear Lake and for use in the vicinity of Yellowknife. The demand for oil products in the latter area is increasing, and deliveries in 1947 reached a new high.

Petroleum exploration has been undertaken in areas other than Norman Wells, but results have been disappointing to date. During 1945 and 1946, exploratory wells were drilled on Redstone River, a tributary of the Mackenzie River, about 125 miles south of Norman Wells, and on the Mountain River approximately 75 miles north of Norman Wells, but failed to produce oil. Extensive exploratory drilling and prospecting for petroleum were also undertaken on the Hay River, near the western end of great Slave Lake, in 1946 and 1947, with the object of defining the Hay River anticline.

In 1948, a syndicate was formed to search for petroleum near Providence.

Radium and Uranium

During a geological survey of the Great Bear Lake region in 1900, J.A. Mackintosh-Bell, of the Geological Survey of Canada, and Charles Camsell, later Deputy Minister of Mines and Resources, observed that the rocks

facing the eastern shores of MacTavish Arm were stained with "cobalt bloom and copper-green." Travelling under pressure just before freeze-up, the party did not investigate the geology in detail. Not until thirty years later were the mineral possibilities of Great Bear Lake established.

In 1929, several parties started prospecting in the vicinity of Hunter Bay and the Sloan River. One of those who explored the district was Gilbert LaBine, a prospector trained in the Cobalt area of Ontario. On his return flight from the area that autumn, LaBine noted evidences of silver and copper on a small island in the vicinity of Echo Bay, 30 miles south of Hunter Bay. The following spring, LaBine returned to the area with his partner, E.C. St. Paul. In May, 1930, they made the great discovery of pitchblende on what is now known as LaBine Point, at the mouth of Echo Bay.

Claims were staked, trenching and test-pitting were undertaken, and samples were brought to Ottawa, where officers of the Department of Mines confirmed them as high-quality pitchblende, the ore of radium and uranium. Plans for the commercial development of the deposits were subsequently made, and a suitable process for the extraction of radium from the Great Bear Lake ore was eventually worked out with the assistance of metallurgists of the Department of Mines at Ottawa.

During 1933, Eldorado Gold Mines, Limited, as the company was then called, completed the erection of a milling plant on the property at LaBine Point, Great Bear Lake. A refinery was also constructed at Port Hope, Ontario. In May, 1933, the first gram of radium was produced at the refinery, and by the end of that year the company was in steady production. Within a short time, Canada had become one of the two important producers of radium in the world. The result was a decline in the price of this substance from $70,000 to $25,000 a gram. To meet the problems of transportation, the company gradually developed a system involving the use of power boats, barges, and oil tankers, now known as Northern Transportation Company Limited.

The production of radium in Canada was well-established by September 1939, when World War II commenced, but in June, 1940, the Eldorado company was forced to close down its mine owing to disorganized world markets. At the time operations were suspended, the Eldorado mine, together with one in the Belgian Congo of Africa, produced virtually the entire world supply of radium. Few realized that the ore from this mine could be the source of material that would have effects more far-reaching than all the radium it had produced. The splitting of the uranium atom was accomplished in 1939, and was subsequently investigated on a wide scale. When the tremendous possibilities of fission were sensed, particularly in application to military operations, the urgency of safe-guarding supplies of uranium available to the United Nations became urgent. In the spring of 1942, the Eldorado mine was reopened with a minimum of publicity, and, after dewatering, was brought back to normal production.

Early in 1944, the shares of the company were expropriated by the Dominion Government. The properties are now operated by a crown Company known as Eldorado Mining and Refining (1944) Limited. During 1944, extensions to the plant buildings were made, and the shaft was enlarged to three-compartment size and deepened to provide additional levels. The concentrates produced at Great Bear Lake are shipped by plane and by other means to the refinery at Port Hope for reduction to radium, uranium salts, and other products. Information relating to the tonnage of ore mined, milled, and shipped has been treated as confidential since 1941. Since the reopening of the mine in 1942, extraction processes at the refinery have been

improved. The Eldorado company is now one of the two foremost producers of uranium in the world, and, while radium has become a by-product, it is nevertheless extremely valuable.

Concurrent with the development program at the Eldorado Mine has been a broad program of prospecting and geophysical surveys carried on in the surrounding territory by a subsidiary of the Crown Company, and by the Geological Survey of Canada. In 1944, activity was also resumed at the property of International Uranium Company Limited, on Contact Lake, southeast of Eldorado mine, where a pitchblende-silver property had been brought to milling stage by Bear Exploration and Radium Limited prior to cessation of operations in 1938. In 1947, more than ten tons of high grade silver ore were shipped, following dewatering of the shaft, reconstruction of the mill which was damaged by fire in 1946, and installation of power plant equipment. Exploratory drilling has also been undertaken on the properties of Gold Uranium Exploration Limited at Hottah and Hardisty Lakes, and a resumption of activity is expected on the claims of the Camsell River Silver Mines, Limited, at the mouth of the Camsell River.

Gold and Other Minerals

Prospecting for gold in the Territories was first undertaken in 1896–97 by miners on their way to the Yukon "Klondike" along the Mackenzie River or "back-door" route. These miners discovered placer gold and lead in the Mackenzie Mountains, lead-zinc deposits near Pine Point on Great Slave Lake, and gold at Yellowknife Bay, but no general mining activity resulted. The discoveries at Great Bear Lake in 1930, however, re-focused attention on the region, and interest was intensified when gold-bearing ore was found in the Yellowknife River area in 1933 and 1934. By 1935, a major rush had developed, and staking had extended north and east of Yellowknife Bay for many miles. Prospecting of claims followed, and several properties were developed into producing mines.

In September, 1938, the first gold brick produced in the Northwest Territories was poured at the Con Mine of Consolidated Mining and Smelting Company of Canada, Limited, situated west of Yellowknife Bay. Other properties in the vicinity which later came into production were the Rycon mine operated by the Consolidated Mining and Smelting Company, Limited, and that of Negus Mines Limited, in 1939; Slave Lake Gold Mines Limited, (now Philmore Yellowknife Gold Mines, Limited) on Outpost Island, and Thompson-Lundmark Gold Mines Limited at Thompson Lake in 1941; and Ptarmigan Mines Limited, near Prosperous Lake, early in 1942. In addition, a shaft was sunk at the Camlaren property at Gordon Lake, and a small mill installed at the Ruth mine of Consolidated in the François Lake area. Some high-grade ore was also shipped by Giant Yellowknife Gold Mines, Limited, from its property on the west shore of Yellowknife Bay, before operations were suspended in June, 1940.

From 1938 to 1942, mineral production in the Yellowknife district increased progressively, reaching a peak in 1942, when gold to the value of $3,826,000 was mined. Of this amount, nearly half came from the adjoining Con and Rycon mines. Silver production, a by-product of gold-mining operations, was $9,500 for the same year. Late in 1942, an increasing shortage of labour and supplies, resulting from war conditions, forced some mining companies to suspend operations temporarily. A general recession in mining activity followed, and, by the end of 1943, all mines with the exception of Negus had either closed down or ceased production. The mill of Negus Mines Limited was closed in September, 1944, but maintenance work and the development of ore reserves were continued at both Con and Negus properties.

Although gold production in the Yellowknife district was suspended in 1944, new developments that year led to greatly increased activity. Control of the Giant Yellowknife property passed to new interests, and a broad diamond drilling program, carried on in 1944 and 1945 after detailed geological examination, disclosed extensive zones of high-grade ore. The ore bodies lie in shear zones traced across the greater length of the property for a distance of more than two miles. These discoveries precipitated an unprecedented rush, and led to intensive prospecting of the entire region. By 1945, approximately 200 mining companies and syndicates owned mineral claims in the district or had an interest in their development. Exploration and staking were extended for a distance of 150 miles beyond Yellowknife Bay, and many new discoveries were reported. Extensive drilling programs have since been carried out on many properties, and where results warranted, underground development has been undertaken.

In the meantime, labour and supply conditions improved, and Negus Mines, Limited, reopened its mill in July, 1945. Gold production was resumed at the mill serving the Con and Rycon mines in August, 1946, and late in September, 1947, the first gold brick produced since 1942 was poured at the Thompson-Lundmark mine. Early in January, 1946, the Con and Negus mines undertook as a joint operation the drilling of a deep-drill hole on the Negus property which intersected the faulted Giant shear zone around the 2,000-foot level. The result of this operation is expected to lengthen greatly the life of the mines concerned.

By the end of 1947, the staking of new ground had slackened in favour of systematic prospecting of claim groups. This included standard and X-ray diamond drilling as well as geological examination and mapping. The most important area, the Yellowknife Bay-River region, contains the gold-producing Con-Rycon and Negus mines, and the Giant mine where production commenced on June 2, 1948, with the official opening August 24, 1948. At both the Con and Negus properties shafts have been deepened, and cross-cutting intersected the Giant shear extension, commonly termed the Campbell Zone. Two shafts have been completed at the Giant property and a third shaft collared. In addition a modern mill has been erected, powered by the Snare River Hydro Electric Power Plant, which was officially opened October 4, 1948. At the Akaitcho property, which adjoins that of Giant to the north, extensive ore bodies have been outlined by diamond drilling, a shaft collared and shaft-sinking will follow the erection of a steel head frame on the property. Extensive development, including the sinking of a shaft, was undertaken at Crestaurum Mines, Limited, 7 miles north of Giant, before work was suspended in 1947. In the Thompson-Hearne Lake area, the Thompson-Lundmark mine is producing gold from its Kim and Treasure Island veins. Shaft-sinking was undertaken at the Sunset mine in the Beaulieu River area, and also at the properties of Discovery Yellowknife and Viking Yellowknife Gold Mines Limited in the Giaque-Quyta Lake area. To the north, in the Indin Lake area, Diversified Mining Interests have completed shaft-sinking with some lateral development undertaken. Diamond drilling, trenching and other development work was also being carried on in the Gordon Lake, MacKay-Courageous Lakes, Ghost Lake, Russell-Slemon Lakes, and Regan Lake areas.

The Northwest Territories are now yielding the concentrates of radium and uranium, as well as gold, silver, and petroleum products in commercial quantities. Other minerals known to occur include lead, zinc, nickel, copper, tungsten, tantalum, beryllium, lithium, and coal.

A large quantity of fair grade lead-zinc ore was revealed by drilling and underground exploration some years ago south of Pine Point on Great

Slave Lake. As the further development of this area necessitated large capital expenditure, a 500 square mile concession was granted by the Dominion Government jointly to the Consolidated Mining and Smelting Company of Canada, Limited, and Ventures Limited, as these companies were technically and financially capable of undertaking a long-range prospecting program with a view to discovery of further deposits of lead and zinc, and the development of such deposits. Favourable progress in drilling operations has been reported from this area.

In other areas active exploration has indicated showings of promise. The high cost of production and transportation will be favourably affected by the new Hydro Electric Power development and the now completed Grimshaw-Hay River Road. Development work has been carried out on tantalum-bearing properties near Ross Lake, about 30 miles northeast of Yellowknife, where Peg Tantalum Mines Limited has erected a small mill, and on Hearne Channel of Great Slave Lake, where DeSteffany Tantalum-Beryllium Mines Limited has done considerable development work, including the erection of a 25-ton test mill. Occurrences of scheelite, the tungsten-bearing mineral, have been examined in the Tibbitt Lake, Beaulieu River, Gilmour Lake, and Gordon Lake areas. A nickel-cobalt occurrence, situated at Sachowia Lake, north of Et-Then Island in Great Slave Lake, has also been examined. Interest in the occurrences of copper in the Coppermine Mountains region was revived when American Metals Corporation undertook diamond drilling operations near Willow Creek, west of the Coppermine River, in 1944 and 1945. The results obtained, however, did not justify further development of the deposits. A more complete description of mineral occurrences in the Northwest Territories will be found in the section on geology on pages 37-42 inclusive.

A sequel to the mining activity in the Yellowknife region has been the development of the settlement of Yellowknife, on the west side of Yellowknife Bay, which now contains many of the conveniences and amenities of a modern town. In 1945 and 1946, additional townsite areas were surveyed to meet the needs of an increasing population. Recent developments included the installation of telephone, water, and sewage services, and the construction of a modern hospital, school, hotel, and theatres, as well as many new homes. (A separate publication describing the settlement of Yellowknife may be obtained on application from the Northwest Territories Service, Department of Mines and Resources, at Ottawa).

The Yellowknife Mining District covers an immense area, and many localities have been prospected casually or not at all. Although thousands of claims have been staked in the past four years, a great many await geological examination. The development of mining in the Northwest Territories has been aided greatly by the geological investigations and mapping work completed by the Geological Survey Division, Department of Mines and Resources, Ottawa. Geological reconnaissance in the Territories during the war years was restricted by the limited staff available and the urgent need for investigation elsewhere, but a broadened program of exploration is now under way. Accurate mapping is an essential adjunct to detailed mineral exploration, and additional areas of Canada's northland are now being photographed and mapped with the active co-operation of the Royal Canadian Air Force.

Mining interest has increased in the Arctic and Hudson Bay Mining District of the Northwest Territories. Most recent staking has occurred in the Nueltin Lake area where 193 claims have been recorded by the Hudson Bay Exploration and Development Company Limited. Previously

58 claims were recorded in the Ennadai Lake area by the Don Cameron Exploration Co. Limited; 40 new claims were staked last autumn at the Belcher Islands by the Belcher Islands Iron Mines Limited, adjacent to their previous stakings in that area.

This year an underwater reservation of 60 square miles in area was granted to Gulf Lead Mines Limited, an Ontario company holding a large concession at Richmond Gulf in New Quebec. This reservation was granted in the public interest by the Dominion Government as recent diamond drilling by the company indicated that the ore deposits are likely to extend under the waters of Hudson Bay and it might be that such submarine deposits would prove the deciding factor as to whether it will be possible to establish a base metal industry in the area.

According to figures released by the Dominion Bureau of Statistics at Ottawa, the value of mineral production in the Northwest Territories was as follows:

	1944	*1945*	*1946*	*1947*	*Total Production to end of 1947*
Gold	$799,838	$333,218	$860,685	$2,188,095	$17,392,399
Silver	5,881	956	5,113	32,655	875,291
Lead	—	—	—	—	490
Copper	1,428	—	—	—	24,102
Tungsten	—	—	—	—	37,674
Crude Petroleum	632,587	136,303	173,392	500,238	2,318,734
Natural Gas	335	335	335	335	3,930
	$1,440,069	$470,812	$1,039,525	$2,721,323	$20,652,620

WATER-POWER RESOURCES AND DEVELOPMENT*

IN RECENT YEARS, aerial photographic surveys and mapping and geological explorations designed to stimulate mineral development have greatly increased the amount and reliability of the information concerning the topography of the Northwest Territories. Many important rivers and lakes have been mapped and reasonably accurate records of the available heads have been secured. A beginning has been made also on the more accurate power surveys necessary before development of a water-power site can take place.

A power survey of the Yellowknife River was made in 1937, and a tentative scheme of development was worked out. Consolidated Mining and Smelting Company applied for the right to develop a site between Bluefish and Prosperous Lakes, about 20 miles north of Yellowknife settlement. The

* Revised in the Dominion Water and Power Bureau, Department of Mines and Resources, Ottawa

initial stage of this development, completed in 1940, was the first water-power project to be brought into operation in the Northwest Territories. The development consists of a dam at the outlet of Bluefish Lake which raises the water 15 feet, and a power-house near Prosperous Lake to which the water is diverted from the upper lake about one-half mile across the divide by means of an open cut a rock tunnel, and a woodstave penstock. The power equipment consists of a turbine rated at 4,700 horse-power and a generator of 4,200 kilovoltampere capacity. Delivery of power from this source was commenced on January 15, 1941, over the 33,000-volt transmission line to the Con-Rycon and Negus mines. This line also served the Ptarmigan mine during the period in which the latter was operated. Power from the project is utilized for distribution in the Yellowknife settlement, and a separate transmission line, 27 miles in length, supplies power to the Thompson-Lundmark mine east of the Yellowknife River.

As a result of increasing mining activity in the Yellowknife district in 1945, the need for additional power to operate properties under development became apparent. As the Bluefish-Prosperous Lakes power plant of Consolidated was not capable of taking on further loads, reconnaissance surveys of the Snare, Emile, Marion, and Lockhart Rivers were made by the Dominion Water and Power Bureau, and permanent gauging stations established on the Snare and Lockhart Rivers. Power surveys were also made on the Snare River system by Giant Yellowknife Gold Mines, Limited, with the object of undertaking a hydro-electric development capable of meeting the power requirements of the company.

Early in 1946, the Minister of Mines and Resources was authorized by Order in Council to enter into an agreement with Giant Yellowknife Gold Mines, Limited, and to undertake the construction, on the Snare River, of the initial stage of a power development capable of meeting the immediate requirements of the Yellowknife Mining District. Following a thorough examination of the site by competent engineers, the Department of Mines and Resources, through the Dominion Water and Power Bureau, awarded contracts for the construction of the dam and power-house, and placed orders for the manufacture of power equipment. The initial stage of the new development, situated at the outlet of Big Spruce Lake on the Snare River, about 90 miles northwest of Yellowknife settlement, will have a capacity of 8,000 horse-power under an average head of 56 feet. When required, second and third stages of the development are possible.

Work on the project was commenced in the spring of 1946, and by March, 1947, the main power tunnel, 136 feet in length, and a small tunnel to carry water to the exciter generators had been completed. In addition, a cofferdam across the northwest channel was constructed, and open cuts leading to the main tunnel and to the site of the power-house were excavated. A considerable amount of construction equipment and supplies, including two steel intake gates, was hauled to the site during the winter of 1946-47, and, during the summer of 1947, progress in the construction of the main dam was made; additional supplies, including power-house equipment, were landed at Yellowknife for transportation to the power-site during the winter of 1947-48. At the time this publication went to press, the plant had been officially opened and limited service to consumers had commenced.

Giant Yellowknife Gold Mines, Limited, has undertaken the construction of the transmission line from the power-house on the Snare River to the company's main camp about 3 miles north of the Yellowknife settlement. After completion, the transmission line will be acquired by the Department of Mines and Resources at cost. Distribution and sale of power to residents

of Yellowknife and to mining companies in the vicinity will be undertaken by a hydro-electric power commission which is being established.

Large areas of Mackenzie District have been surveyed by aerial methods in recent years so that the drainage areas of the principal rivers may be closely defined and the locations of falls and rapids definitely established. In the districts in which mining and prospecting operations have been more active, the actual drop in a number of the falls and rapids has been measured in the course of reconnaissance power investigations or geological and other surveys. In vast areas tributary to Hudson Bay and the Arctic Ocean, however, information on the rivers is limited to reports by a few travellers.

In general, owing to the inaccessibility, lack of development, and sparsity of population of the Territories, little precise information on stream flow has been accumulated. A number of miscellaneous stream measurements have been made on some of the rivers, but the only stream flow record of any length is that of the Yellowknife River above Prosperous Lake, where the record is practically continuous from 1937 to date. In estimating the power available on many of the rivers, it is necessary to assume run-off factors based on drainage areas.

From the limited information available, tentative estimates indicate a total of 362,700 horse-power available under conditions of ordinary minimum flow and 772,000 horse-power ordinarily available for six months of the year. This is considered to be a minimum estimate as, in general, it covers only the more important rivers and those sites concerning which some more or less definite information has been received; it is subject to revision as more precise data become available. Of the total available power, as stated, only 4,700 horse-power has been developed, although a further 8,000 horse-power is expected to be added during 1948.

From present knowledge, one of the most attractive rivers in the Territories from the view-point of water-power development is the Lockhart, which discharges into the eastern end of Great Slave Lake, and on which a reconnaissance survey was made in 1947. This river has a fall of 118 feet in the 30-mile stretch between Mackay and Aylmer Lakes, and 660 feet in the 20-mile section between Artillery and Great Slave Lakes. Two sites on the upper river are estimated to be capable of small developments, but the potential capacity of the lower river is estimated at 125,000 horse-power. Any development, however, would involve lengthy transmission lines to existing power markets.

The rivers flowing into Great Slave Lake from the south are less favoured with lake storage reservoirs, and winter run-off is low. The Taltson-Tazin River system, which enters Great Slave Lake from the south, has many rapids and falls, the Twin Gorge fall on the Taltson, with a natural fall of 90 feet and a reported feasible developed head of 120 feet, being particularly notable. The total power resources of the River are estimated to be about 200,000 horse-power. A portion of the flow of the upper Tazin was diverted south into Lake Athabaska for a power development near Goldfields, Saskatchewan, which, however, is not at present being operated. There are also smaller power possibilities on the Hay, Snowdrift, and Kakisa Rivers perhaps totalling 50,000 horse-power at ordinary six months flow.

Where it cuts through the Franklin Mountains, the Great Bear River has rapids which afford a power head of about 25 feet. The vast area of Great Bear Lake is available to equalize the flow and allow production of roughly 30,000 horse-power of firm power. Tributary to Great Bear Lake is the Camsell River, upon which surveys have been made with a view to power

development for mining purposes. At White Eagle Falls, a head of 70 feet can be realized. This would produce 4,000 horse-power at estimated minimum flow and in excess of 6,000 horse-power with regulation on the series of lakes immediately upstream.

The western tributaries of the Mackenzie River below Great Slave Lake are mountainous streams with a steep gradient offering numerous power sites, but little storage is available to supplement low winter flow. At Virginia Falls on the South Nahanni River there is a descent of over 300 feet having a power capacity estimated at 5,000 to 12,500 horse-power. Other possible power sites are believed to exist on the Liard and Peel Rivers.

Some of the rivers flowing into the Arctic Ocean, including the Coppermine and Back Rivers, appear to have considerable power possibilities. Flow measurements were undertaken on the Coppermine River in 1947, but detailed information is lacking for proper appraisal. This also applies to the rivers flowing into Hudson Bay. It has been estimated that 18,500 horsepower might be developed at Bloody Falls on the Coppermine under a head of 80 feet. The Dubawnt River appears to have a power capacity of over 200,000 horse-power covering eight listed sites.

At the southern edge of the Northwest Territories, on the Slave River above Fort Smith, where there is a drop of 110 feet in 18 miles, it is estimated that from 220,000 to 506,000 horse-power could be developed at two concentrations; most of this power is in Alberta, but it would be readily available for use in the Northwest Territories.

THE FUR INDUSTRY

THE FUR TRADE in the Northwest Territories had its beginning in the latter part of the seventeenth century, when the Hudson's Bay Company received its charter from Charles II to trade into these northern regions. From then until 1939, when the value of furs was exceeded by that of minerals, fur trading continued to be the most important industry in the Territories. The trapping of fine furs is still, and is likely to continue to be, the chief occupation of most of the native population. Trading posts are scattered throughout the Territories and the history of the vast region is intimately associated with that of the fur trade.

The expeditions of Hearne in 1770-72 and Mackenzie in 1789 opened up new territory for the early traders, and the fur trade expanded rapidly. A chain of posts was established by the North West Trading Company along the Mackenzie waterways at intervals of about 150 to 200 miles. This system was continued and expanded by the Hudson's Bay Company, following the amalgamation of the two companies in 1821. The forts or trading posts were situated in strategic places, and later became the nuclei of some of the present settlements. The same conditions prevailed along the coasts of the Eastern Arctic, where the Revillon Frères Trading Company and the Hudson's Bay Company operated until the latter company absorbed the former in 1935-36. In the Eastern Arctic, most of the independent trading companies have retired from the field, leaving the greater part of the fur trade in possession of the Hudson's Bay Company. In Mackenzie District, however, independent traders operate in competition with the latter company.

Annual Yield

In total value, the Arctic (white) fox usually leads other kinds of pelts taken annually in the Northwest Territories. Chief among the other furs of economic importance are muskrat, beaver, mink, lynx, and red fox in its

three colour phases — red, cross, and silver. Smaller numbers of marten, ermine (weasel), otter, squirrel, wolf, wolverine, and bear are also taken.

The value of fur production in the Territories during the past five years, as determined by the Dominion Bureau of Statistics, is as follows (year ended June 30):

Year	*No. Pelts Taken*	*Value*
1941–42	445,336	$2,840,701
1942–43	385,440	3,165,107
1943–44	297,633	2,199,132
1944–45	258,931	1,743,710
1945–46	565,065	2,750,183

Natural fluctuations in the numbers of the various species of wildlife influence the fur yield. These fluctuations are being carefully studied by the Dominion Government in co-operation with the Bureau of Animal Population at Oxford University, and much information is being obtained in an endeavour to ascertain their causes.

Native Game Preserves

Native game preserves have been established in the Northwest Territories to assist in maintaining the basic industry of the native population. The right to trap within these preserves is confined to Indians and Eskimos and to half-breeds leading the life of natives, with the exception of such white trappers as were already operating when the areas were set aside as preserves. A list of these preserves follows:

Name	*Date Established*	*Area in Square Miles*
Yellowknife	Sept. 22, 1923	70,000
Slave River	" " "	2,152
Peel River	" " "	3,300
Arctic Islands (land area)	July 19, 1926	772,302
Mackenzie Mountains	May 3, 1938	69,440
		917,194

Other steps have been taken by the Northwest Territories Administration to maintain the fur industry and to preserve species in danger of extinction. Hunting and trapping are prohibited in the Thelon and Twin Islands Game Sanctuaries. Thelon Game Sanctuary is situated in eastern Mackenzie District and extends into Keewatin District. It has an area of 15,000 square miles and contains the largest herd of musk-ox remaining on the mainland of North America. Twin Islands Game Sanctuary, situated in James Bay, has an area of 55 square miles.

Wood Buffalo Park, with an area of 17,300 square miles, of which 3,625 square miles are in the Northwest Territories, was established mainly for the preservation of a herd of wood bison or buffalo. The park now forms a vast preserve for many other species of big game and fur-bearing animals. In the establishment of the park, the protection and increase, not only of buffalo but of other game species, were intended. Consequently, in keeping with a policy of strict conservation, travellers to the region must obtain permission to enter the park from the Superintendent of Forest and Wildlife Management at Fort Smith. Indians, half-breeds, and whites who trapped within the area before the park was established are permitted to hunt and trap under licence. The buffalo are rigidly protected.

Wildlife Management

Some years ago, the serious depletion of the wildlife of the Northwest Territories forced the decision to restrict the issue of hunting and trapping licences to British subjects who, prior to May 3, 1938, had taken up perma-

nent residence in the Northwest Territories and who were dependent upon hunting and trapping for a living. The wildlife resources have not increased everywhere since that time, because of drought conditions and forest fires which destroyed a large part of the forest cover.

The Northwest Territories Administration made substantial progress in the establishment of a forest and game protective service during the period 1945-48, and the problems of wildlife resources management are now under intensive investigation. The native population is also being encouraged to observe conservation practices.

A summary of the Game Regulations for the Northwest Territories will be found on page 63.

THE REINDEER INDUSTRY

THE CANADIAN GOVERNMENT, through the Northwest Territories Administration, has continued its effort to establish reindeer herding as an industry for the natives in northern parts of the Dominion. This undertaking was intended to broaden the basis of subsistence of the Eskimos and Indians, and to conserve the natural resources on which they depend. The industry was commenced in March, 1935, when a herd of 2,370 semi-domesticated reindeer driven overland from northwestern Alaska was delivered to a reserved area of 6,600 square miles in the Northwest Territories on the east side of the Mackenzie delta. The reindeer have become adapted to their new environment, and have increased substantially in numbers.

The reindeer industry was established in Canada following the study by a Royal Commission of the possibilities of developing reindeer and musk-ox herds. In its report of 1922, the Commission recommended that experimental herds of reindeer be placed in selected locations, and in the period 1926-28 the Dominion Government undertook a reconnaissance of the area lying along the Arctic Coast between the Yukon-Alaska boundary and the Coppermine River and north of Great Bear Lake. The investigations were made by A. E. Porsild, an experienced botanist, assisted by his brother, R. T. Porsild. Prior to the study of the Canadian range, the investigators visited Alaska to observe the conditions under which reindeer were handled.

In 1929, arrangements were made for the purchase of 3,000 reindeer, which were delivered by an Alaskan reindeer company to a selected range in Canada near the mouth of the Mackenzie River. The range was later established as a reindeer reserve. The herd selected for the overland drive by A.E. Porsild consisted of 2,890 does, 307 bucks, and 250 steers, the latter being for food and draught purposes. The drive was in charge of Andrew Bahr, veteran Lapp reindeer herder, who was assisted by a number of other Lapps and several Eskimos. Many difficulties were encountered. Some of the animals returned to their home range. Blizzards, intense cold, wolves, straying, accidents, and other obstacles impeded progress. The losses to the herd were severe, but these were recouped to some extent by the fawn crop each year. The reindeer arrived in Canadian territory in 1933, but the crossing of the Mackenzie River to the reserve, delayed by difficult weather and ice conditions, was not effected until the winter of 1934-35.

Meanwhile preparation for the reception of the herd had been made. A corral was constructed at Kittigazuit on the Arctic Coast, and buildings were erected for the accommodation of the reindeer staff and supplies. The headquarters station for the supervision of the reindeer field-work is about 40 miles inland on the right bank of the east channel of the Mackenzie River,

at the foot of the Caribou Hills, latitude 68° 41′ N; longitude 134° 07′ W. It is about 40 miles by air and 75 miles by water from Aklavik. Improvements have been carried out at the station since it was constructed, and, in 1938, radio equipment was installed to provide communication with the Northwest Territories Administration at Ottawa. Messages are relayed by the Royal Canadian Corps of Signals unit at Aklavik.

The corrals used for the annual round-up of the main herd are now located on Richards Island, the principal summer range. Here the animals are counted and classified about the end of July. The fawns are marked, breeding stock is properly proportioned, and the animals surplus to requirements are selected for slaughter later in the year. During the period of development, 1935-1947, large quantities of reindeer products, chiefly meat and hides, were utilized by the herders and others directly connected with the reindeer industry. Substantial donations of reindeer meat were made to mission hospitals and residential schools which care for the native population. Surplus products were sold to white and native residents of the region. Some of the skins of adult reindeer taken for meat were shipped to the Eastern Arctic, where they were urgently needed for use by the natives in lieu of caribou hides for the manufacture of winter clothing and for bedding.

The training of young natives in reindeer work proceeded steadily, and branch herds were established in 1938 and 1940 under native management. The reindeer comprising the native herds were entrusted to Eskimos who had served as apprentice herders. They received the deer under a lending arrangement subject to the return of a similar number of animals as the herds increased in size. A serious setback, however, occurred in 1944, when the native proprietors of these herds, with members of their families and a white supervisor, lost their lives in the wreck of a native schooner in a storm off the Arctic Coast. The reindeer which had been herded by these natives became scattered, and those that could be reassembled have since been herded as a Government unit in the Anderson River area.

At the round-ups held in the summer of 1947, there were more than 4,200 deer in the main herd located on the reserve, and about 2,000 head in the subsidiary herd near the Anderson River. These animals are the nucleus from which native herds may be established.

The handling of the reindeer at the annual round-ups and other occasions and the presence of herders at all times tends to prevent the animals from becoming wild and difficult to control. Some of the mature steers in the herds are trained to harness for transporting supplies and firewood, moving the herd camp, and similar work. The use of reindeer milk from Canadian herds is negligible at present. This practice requires the roping of the does, an impractical procedure in the case of large herds.

The reindeer migrate in spring from the inland winter ranges to the summer feeding grounds in the coast area, and return to the winter ranges n the early winter. The winter feed is principally reindeer moss, but in the summer the diet includes a variety of vegetation including grasses, shrubs, and sedges. One of the reasons why the reindeer move to the coast in the summer is to escape from insect pests, which are less numerous there because of the winds from the Arctic Ocean.

The extent to which reindeer herding may be developed in northern Canada depends largely on whether sufficient numbers of the natives accept the herders' mode of life. The abundant fur yield and high fur prices in recent years have tended to attract young, intelligent natives to the occupation of trapping rather than to the more monotonous life of a herder. As a result

there is a scarcity of herders, and the development of a group of natives able to manage reindeer herds and sell their surplus products to other residents of the region has been retarded.

The Northwest Territories Council and an Inter-departmental Committee on Northern Agriculture have studied the problems related to the development of the reindeer industry in Canada, and, in 1947, two qualified investigators visited the Reindeer Station and inspected the herds and the range. They reported the animals to be in a healthy condition, with an abundance of suitable pasturage available. Recommendations by these officers for improvements in herd and range management are receiving careful study and attention.

The general supervision of the reindeer industry is now part of the responsibility of the Superintendent of Forest and Wildlife Management in Mackenzie District. He is assisted by a Superintendent of the Reindeer Range Station, an experienced foreman, and a staff of labourers and herders, most of whom are Eskimos.

AGRICULTURE

AGRICULTURAL DEVELOPMENT in the Northwest Territories has been limited to the valleys of the Mackenzie River and some of its tributaries. Climatic, geological, and to pographical conditions place the major part of the Territories outside the zone of possible agricultural operations. This is particularly true of the Eastern Arctic region, where lack of developed soil and shortness of the growing season are contributing factors.

Small-scale farming operations and gardening, however, have been carried on in Mackenzie District since the earliest days of exploration and settlement. Much of the pioneer work was undertaken by missionaries and fur-traders, who planted vegetables for their own use, imported a few head of live stock and horses, and even succeeded in growing small quantities of grain for feed.

By 1826, gardens were kept at all Hudson's Bay Company posts as far north as Fort Good Hope. Garden trials were undertaken for the Department of Agriculture by the Oblate missions of the Roman Catholic Church in 1911 at a number of settlements along the Mackenzie River, including Fort Smith, Fort Resolution, and Fort Providence, and later at Fort Good Hope.

These trials, continued until 1940, indicated that reasonably good crops of hardy vegetables, especially potatoes, could be obtained in most seasons. Occasional trips down the Mackenzie River were also taken by the superintendents of the Department of Agriculture experimental station at Beaverlodge, Alberta.

In January, 1943, an Inter-departmental Committee, composed of representatives of the Departments of Agriculture and Mines and Resources, was formed to assist in the improvement and promotion of agriculture in the Northwest Territories and Yukon. On the recommendation of the committee, field investigations, including soil and horticultural surveys, were undertaken in Mackenzie District in 1944 and 1945.

Investigations of soil conditions along the Slave, Liard, and Mackenzie Rivers were made by a soils specialist. In addition, most of the settlements along the Slave and Mackenzie Rivers were visited by a specialist in horticulture, who organized comprehensive trials with vegetable and flower seeds as well as fertilizer. Advice was furnished to residents engaged in

gardening, and a number of these selected as co-operators were given samples of seeds, roots, and plants suitable for northern latitudes. In addition, intensive experiments in growing field and garden crops on several types of soils in the vicinity of Yellowknife were undertaken in 1945.

Reports of the soil survey indicated that, although there are no extensive areas suitable for agricultural purposes in the Liard River Valley, river bottom land suitable for gardening and small scale farming occurs practically continuously along the river from a point about 60 miles above Fort Simpson to the British Columbia boundary. In the aggregate, the area of such lands would total many thousands of acres, but the development would entail heavy clearing operations. The settlement of Fort Simpson, situated at the junction of the Liard and Mackenzie Rivers, is located on an island of good soil, but the surrounding mainland regions offer little opportunity for agricultural development. From Simpson southward to Trout River, no large areas suitable for agriculture were seen, but from Trout River to Fort Smith large areas of low-lying land, probably of alluvial deposition, occur. Some of this land is believed suitable for agricultural development, particularly near the mouths of tributary streams and along the lower reaches of the Slave River, but heavy clearing operations will be entailed here as well.

The horticultural survey revealed considerable success in the raising of vegetables for local consumption. Improved yields, however, are believed possible by the planting of earlier-maturing varieties of seed, more extensive use of fertilizers, and irrigation where the soil lacks moisture or rainfall is scanty. From Fort Simpson northwards, some areas suitable for agriculture were observed on bench lands bordering the Mackenzie River and in the vicinity of existing settlements.

As a result of these surveys, plans were made for the establishment of experimental substations at Fort Simpson and Yellowknife. An experienced agriculturist was appointed to take charge of the Fort Simpson station in late 1946, and experimental work was commenced in 1947. This included the brushing, breaking, and cropping of land, and the construction of necessary buildings. Vegetable trials under the direction of a graduate horticulturist were also made on the two main types of soils in the vicinity of Yellowknife. The officer in charge of the Fort Simpson substation visits various settlements along the Mackenzie River and assists those engaged in agricultural activities.

The following brief notes on present conditions at the various settlements are based on recent observations of qualified investigators.

Fort Smith — Fort Smith is situated on sandy soil once covered by poplar and jack pine. The use of fertilizer and water improves yields. A number of gardens produce good root and leaf vegetables. Strawberry, raspberry, and other small fruit bushes bear fair crops. Dairy cattle, poultry, and horses are maintained in the vicinity. Wheat and oats grown by the Roman Catholic mission ripen and are used for feed. Wild hay is available in the vicinity.

Fort Resolution — Most of the common vegetables can be grown here with fair success. Potatoes have yielded 200 bushels to the acre in good years. Good oat crops have been obtained for feed; alfalfa and sweet clover plots have done well. A small herd of cattle is kept at the Roman Catholic mission farm.

Hay River — Soil at Hay River is black silt loam overlying sand. Summer climate is windy and dry. The Anglican mission garden has produced potatoes, celery, turnips, carrots, radishes, green tomatoes, and occasionally fodder corn.

Fort Providence — Horticulture has been carried on here since 1867. Potatoes, cabbage, lettuce, and radishes are grown, and tomatoes have ripened out of doors. Horses, cattle, and poultry are kept at the Roman Catholic mission.

Trout River — Many varieties of garden vegetables are grown on a small farm and potatoes are shipped in quantity to places farther north. The soil is a black clay loam.

Yellowknife — Although areas suitable for horticulture are not numerous, several gardens in the vicinity produce good vegetable crops. Most of these lie between the rock ridges characteristic of the region. The soil is generally clay which is overlaid with loam and moss and requires irrigation as rainfall is light. Varieties grown outdoors include potatoes, cabbage, cauliflower, broccoli, spinach, lettuce, radishes, carrots, turnips, beets, peas, and rhubarb. Poultry is raised, and, with the aid of heat and light, eggs are produced throughout the winter. There is a good market for local produce and two market gardeners operate with considerable success.

Fort Simpson — Live stock raising has been carried on at Fort Simpson for years. Brome grass, oats, and barley are grown for feed. Experimental tests carried on by a resident in co-operation with the Department of Agriculture for some years are being continued at a new experimental Substation. Potatoes and root crops usually give fine yields, and syrup has been made from sugar beets grown locally. Vegetable crops include peas, radishes, lettuce, cauliflower, cabbage, beets, carrots, rhubarb, and spinach.

Fort Liard — Gardens are situated on river terrace land, and produce potatoes and other vegetables. Tomatoes also ripen regularly.

Fort Norman — Gardens have been cultivated for years. With sufficient rainfall, good crops of cabbage, potatoes, lettuce, carrots, beets, and peas are obtained. Some poultry, brought in as chicks, is also kept by residents.

Norman Wells — Several gardens situated on bench land above the Mackenzie River produce good leaf crops, in addition to radishes and potatoes. The soil is basically clay loam.

Fort Good Hope — Small gardens do well at this settlement, which is situated just 20 miles south of the Arctic Circle. Leaf crops, potatoes, and root crops are practicable. Wild raspberries and gooseberries are very plentiful.

Arctic Red River — A few small gardens are situated on high, well drained loam soil. Root crops, potatoes, cabbage, cauliflower, peas, and lettuce grow well.

Fort McPherson — A garden at the Anglican mission produces good crops of leaf and root vegetables, including cabbage, cauliflower, and rhubarb. Tomatoes, squash, and marrow are also grown in a small greenhouse. Poultry is raised from imported chicks and the eggs are sold. Cereal grains have also made good growth and barley has ripened.

Aklavik — At Aklavik, more than 100 miles north of the Arctic Circle, gardens of alluvial soil produce leaf vegetables, carrots, turnips, beets, potatoes. The use of fertilizer increases yield. Tomatoes thrive and ripen in greenhouses. Some residents keep poultry raised from imported chicks, on imported feed. An experiment in dairy farming undertaken by a former Government medical officer at Aklavik was discontinued when the doctor left the settlement. Goats, however, are kept by another resident of the district, and a good supply of milk is obtained from them.

In addition to garden crops, both annual and perennial flowers thrive at most settlements. The best results are obtained from the transplanting of seedlings. Experiments now being carried on by co-operators are expected to assist in determining the best varieties for various locations.

In view of the shortness of the open season, the frost hazard, danger of drought, limited facilities for transportation, and other unfavourable conditions, the achievements outlined above are significant. However, much of the success attained is due to the diligent work of those concerned.

It is believed that cropping in Mackenzie District will be confined essentially to the sedimentary lowland. Most of the soils of agricultural value are the products of alluvial deposit and water assortment. Of the land from Fort Simpson northward, the creek valleys are considered to be the most suitable for the raising of farm produce. There is much muskeg, but this is sometimes capable of successful cultivation. Back from the main streams, much of the Mackenzie Valley has been repeatedly fire-swept. Large areas may be expected to represent a rather inferior class of woodland soil.

A characteristic of the lower Mackenzie region is permanently frozen subsoil. Forest and field crops grow above permanent frost. In parts of Siberia, agriculture is carried on above subsoil frozen to a depth of many hundred feet. The length of day affects crops variously according to their specific habits. The potato responds favourably to a long day with a low temperature.

Although agriculture is impractical in the Eastern Arctic, a number of Government officials, traders, and missionaries grow vegetable plots under glass, using imported soil and fertilizers. At Chesterfield on Hudson Bay, salad vegetables have been grown successfully on a small plot of native soil without the aid of glass, and poultry has been raised for the production of fresh eggs.

Experienced observers are in agreement that before any part of the north is opened for agriculture, conditions should be carefully studied and the most likely areas selected. If, then, settlement commences along the river fronts, working gradually back and utilizing the safer locations for the less hardy crops, frost may be combated with the best chances of success. Ultimately it may be possible to introduce poultry and domestic cattle to these new locations, to grow field crops to some extent, and to operate profitable gardens almost to the Arctic Ocean.

GENERAL INFORMATION

Opportunities for Employment

THE MINING INDUSTRY and, to a lesser degree, associated developments, offer most of the opportunities for employment in the Northwest Territories. A National Employment Office has been established at Yellowknife by the Department of Labour, and its manager is actively in touch with those able to offer employment in the district. In addition, the National Employment Service at Edmonton, Alberta, and the Agent of the Northwest Territories Administration, whose office is in the McLeod Building, Edmonton, possess reliable information about employment conditions in the Mackenzie District. Men employed in the mining industry must be in first class physical condition, and must undergo a medical examination before being hired.

Business Opportunities

There are limited opportunities for commercial enterprises in the Territories, and, in districts such as Yellowknife, such opportunities correspond with expansion of the mining industry. Those planning to enter business at

Yellowknife or other settlements are urged to visit the proposed site and canvass the situation beforehand. Lumber and building materials are still in short supply, and transportation costs are high.

Supplies and Commodities

Most foodstuffs, other than fresh fruit and vegetables, are imported during the summer months when lower freight rates are offered by water transportation. Unexpected growth in population affects supplies, which, in the event of shortage, must be replenished by use of tractor train or aircraft at increased cost. The cost of living at settlements in the Northwest Territories is much higher than in the provinces, principally on account of transportation costs.

Fresh vegetables are grown and may be purchased at many of the settlements in Mackenzie District during the summer months. Practically all dairy products, however, are imported, and condensed or evaporated milk is used almost exclusively. Some eggs are produced and sold at Yellowknife and other points along the Mackenzie River system. Both wood and oil are used for fuel, although oil is gradually replacing wood in the larger settlements. Fuel oil sells for about 30 cents a gallon at Yellowknife.

Immigration Requirements

Citizens of the United States or other countries desiring to engage in business or take employment in the Northwest Territories should apply to the Director, Immigration Branch, Department of Mines and Resources, Ottawa, for information concerning immigration requirements.

Maps

Topographical maps of the Northwest Territories on various scales may be obtained at nominal cost from the Surveys and Mapping Bureau, Department of Mines and Resources, at Ottawa. Geological maps of mineral areas are available at the Geological Survey of Canada, Department of Mines and Resources, Ottawa. Map index sheets or lists of available maps may be obtained free of charge from these services.

General

Requests for general information concerning all matters relating to the Northwest Territories should be addressed to the Northwest Territories and Yukon Services, Lands and Development Services Branch, Department of Mines and Resources, Ottawa.

INFORMATION CONCERNING THE ADMINISTRATION OF CROWN LANDS, TIMBER, GRAZING, AND HAY

Lands in the Northwest Territories are administered by the Department of Mines and Resources under the Dominion Lands Act.

Except for the lots comprising the various settlements, lands in the Northwest Territories are not surveyed, and consequently are not open to purchase. Lands selected for some particular purpose may be purchased after survey is made at the expense of the buyer.

Small tracts of unsurveyed land for fur-farming and agricultural purposes and for use in connection with fishing operations or other business purposes may be obtained by lease. The application fee is $10 and the minimum annual rental is 50 cents per acre. Annual rental for each lease is based on the acreage, the nature and location of the land, and the purpose for which the land is to be used. Leases so granted cover the surface rights only and do not give the lessee any claim to minerals.

In some of the surveyed settlements, lots are disposed of by sale to transportation companies, traders, and missions in connection with their undertakings, and to settlers for residential or business purposes. None of these lots is looked upon as having agricultural value.

Under the Timber Regulations, annual permits are granted for the cutting of timber, subject to payment of a permit fee of $1; payment of dues as set out in the Regulations; and to the payment of annual ground rental at the rate of $100 per square mile where the cut is to exceed 100 cords or where timber is required for sawmill purposes.

Grazing leases and permits to cut hay on vacant Crown lands may be obtained under provisions of the Hay and Grazing Regulations.

Applications for land, timber, hay, or grazing privileges should be filed with the Agent of Dominion Lands at Fort Smith, Northwest Territories, or if the lands affected are in the vicinity of Yellowknife settlement, with the Agent of Dominion Lands at Yellowknife, Northwest Territories.

Copies of Timber, Hay, and Grazing Regulations may be obtained from the Agents of Dominion Lands at Fort Smith or Yellowknife, Northwest Territories, or from the Lands Division, Lands and Development Services Branch, Department of Mines and Resources, Ottawa, Canada.

SUMMARY OF QUARTZ MINING REGULATIONS

A summary of the regulations governing the disposal of quartz mining claims on Dominion Lands in the Northwest Territories follows:

Miner's Licences — Any person 18 years of age and over, and any joint stock company incorporated or licensed to do business in Canada, is eligible, on payment of the prescribed fee, to obtain a miner's licence. The annual fee for an individual miner's licence is $5; for companies, according to the schedule as set out in the regulations. Individual licences may be obtained from the Mining Recorders and Sub-mining Recorders in the Northwest Territories and at Edmonton, Alberta, or from the Lands and Development Services Branch, Department of Mines and Resources, Ottawa. Company licences are obtainable only at Ottawa.

Number of Claims which may be staked by licensee — Each licensee may, in any one mining division and in any one licence year (April 1 — March 31), stake and record six (6) claims for himself and six (6) claims each for two other licensees (proxies), or a total of eighteen claims.

Size of Claims — Not to exceed 1,500 feet in length by 1,500 feet in breadth, with boundaries running as nearly as possible north, south, east, and west, and all angles to be as nearly right angles as possible. The total area of the claim should not exceed 51·65 acres. Claims to be marked on the ground with four legal posts, number one post to be placed at northeast corner. Boundary lines between each post to be marked out by removal of trees, brush, and obstructions, and by blazing trees at each side of and adjoining such boundary lines. Prospectors are urged to exercise care in planting claim posts and in cutting and marking boundary lines, and are also warned of the penalties which may be incurred in connection with oversized claims.

Recording — Application for the granting of a claim must be made on the prescribed form to the Mining Recorder or Sub-mining Recorder for the district within fifteen days of staking if claim is located within ten miles of the office of the said Recorder or Sub-mining Recorder. An extra day is allowed for each additional ten miles or fraction thereof. The fee for recording a claim is $5, if recorded on staker's licence; if recorded on behalf of another licensee, the fee is $10 per claim.

Grouping — Adjoining claims not exceeding thirty-six in number may be grouped for the purpose of representation work. Fee for grouping certificate, $5.

Representation work — Claims may be held for a period of one year and thence from year to year, without the necessity of re-recording, provided that representation (development) work to the value of $100 is performed on the claim each year and the owner renews his miner's licence annually. In general, after work to the value of $500, including cost of survey of the claim, has been performed, and other conditions met, a lease covering a period of 21 years may be applied for.

Other Mining Regulations

In addition to the foregoing, copies of regulations governing the disposal of the following rights on Dominion Lands are available: *Placer Mining; Coal; Dredging; Petroleum and Natural Gas; Quarrying; Sand, Stone, and Gravel.*

Copies of all Mining Regulations may be obtained from the Mining Recorders at Fort Smith and Yellowknife, N. W. T., or from the Northwest Territories Service, Lands and Development Services Branch, Department of Mines and Resources, Ottawa, Canada.

SUMMARY OF THE GAME REGULATIONS

HUNTING AND TRAPPING in the Northwest Territories are controlled by the provisions of the Northwest Game Act and Regulations. The wildlife resources of the Territories are limited, and as the native Indians, Eskimos, and half-breeds are dependent upon hunting and trapping for a livelihood, the issue of licences for these activities is restricted.

Hunting and Trapping Licences

Licences to hunt and trap may be issued to the following persons only:—

(1) Residents of the Northwest Territories, as defined by Regulations, *who on May 3, 1938, held hunting and trapping licences and who continue to reside in the Northwest Territories.*

(2) The children of those who have had their domicile in the Northwest Territories for the past four years, provided such children continue to reside in the Northwest Territories.

(3) Such other persons as the Commissioner of the Northwest Territories may decide are equally entitled to licences under these regulations.

(NOTE) — Only British subjects with four years' residence in the Northwest Territories are eligible for licences under Clause 2.

A minor under the age of fourteen years shall not be eligible for a licence. A minor, assisting his parents or guardians in connection with hunting or trapping operations, will not require a licence.

Wildlife conditions have been aggravated by forest fires, and reduced precipitation has lowered water-levels, resulting in dried-up streams and lakes where wildlife formerly was abundant. As a result, the trapping of beaver and marten is restricted.

A licence to shoot game birds during the open season may be issued to any person who is ineligible for the regular hunting and trapping licence. The fees for game bird licences shall be:—

(a) For resident British subjects	$2.00
(b) For non-resident British subjects	5.00
(c) For other non-residents	10.00

The Northwest Territories Game Regulations make provision whereby explorers, surveyors, or propectors engaged in any exploration, survey of mining operations, or other examination of the Territories may take or kill moose, caribou, and non-migratory birds such as ptarmigan if *in dire need of such game for food.* For the purpose of the regulations, *in dire need* means the shortage of food making it essential to kill such game for fresh meat (*food*) in order to sustain life or prevent starvation.

Copies of the Regulations respecting Game in the Northwest Territories may be obtained on application to the Northwest Territories and Yukon Services, Lands and Development Services Branch, Department of Mines and Resources, Ottawa, Canada.

SUMMARY OF SPORT FISHING REGULATIONS

Angling in waters of the Northwest Territories by residents and non-residents is permitted without licence.

Fishing is prohibited each year for the undernoted species of fish as follows:

Lake (salmon) trout — September 16 to November 30.

Pike and pickerel (walleye) — April 1 to May 15.

The use of spears, lights, firearms, and dynamite or other explosive material in killing fish is prohibited.

The use of bare, unbaited hooks or grapnels is prohibited.

Provision is made in the fishing regulations whereby explorers, prospectors, surveyors, or travellers, while engaged in exploration, mining, or survey operations, or other examination of the Northwest Territories, may fish at any time without a licence, but with legal implements, for their own domestic use.

Special regulations govern commercial fishing in the Territories.

Additional information, including copies of the Regulations governing Fishing in the Northwest Territories, may be obtained from the Department of Fisheries, Ottawa, Canada.

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A group of Eskimo women and children at Pangnirtung, southern Baffin Island.



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THE NORTHWEST TERRITORIES

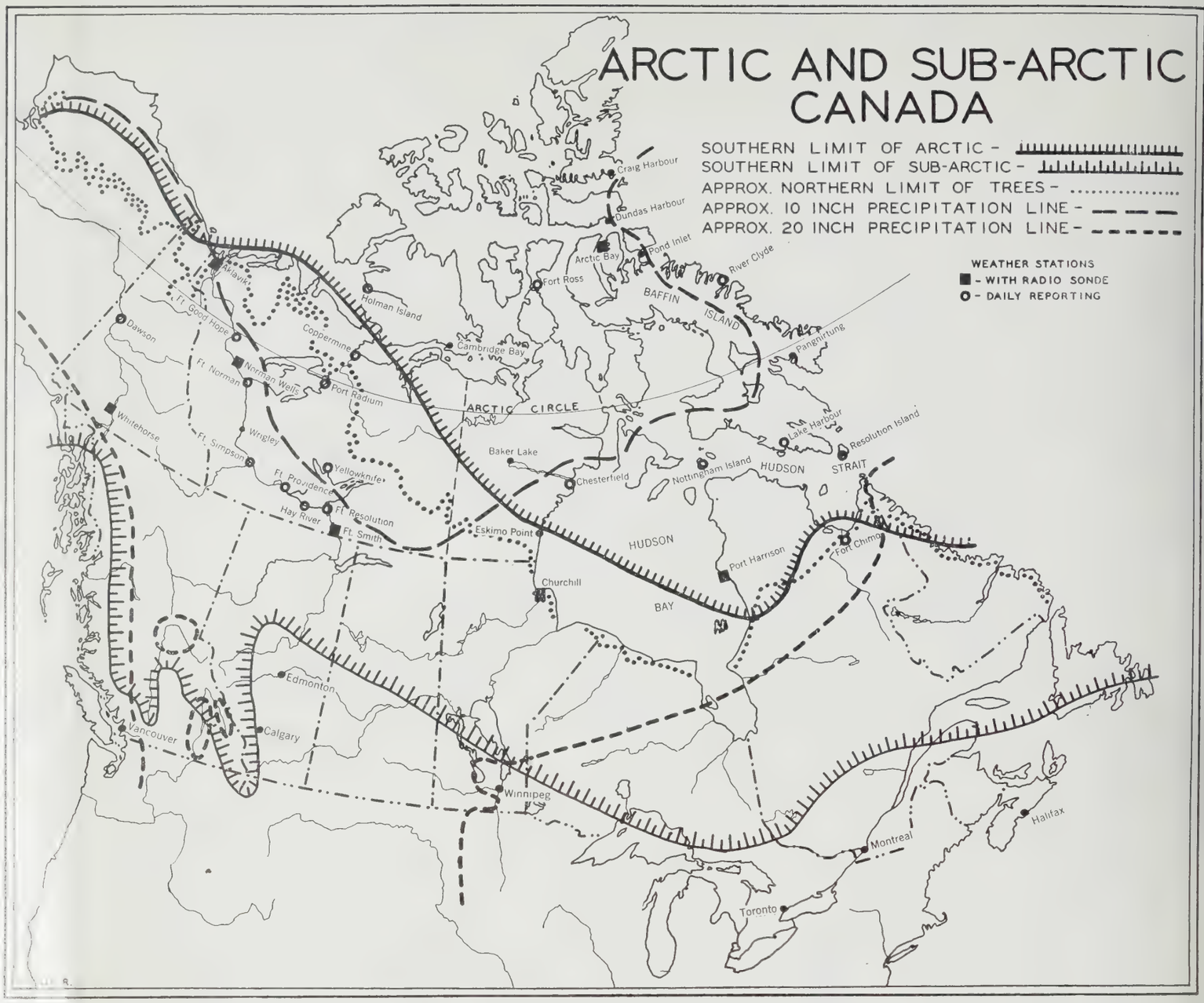


ADMINISTRATION, RESOURCES AND DEVELOPMENT

WEATHER AND CLIMATE OF THE NORTHWEST TERRITORIES



Reprinted from the CANADIAN GEOGRAPHICAL JOURNAL,
March, 1946



*Weather and Climate of the Northwest Territories**

by J. LEWIS ROBINSON**

Photos by the author unless otherwise credited

NORTHERN CANADA is a bleak land of frozen wastes and barren rocky hills—it is a land of extensive green forests and a great variety of colourful flowers. Northern Canada has recorded some of the coldest temperatures known in North America—it has had hot summer days during which temperatures of almost 100° F. promoted rapid growth. These statements, although seemingly contradictory, are nevertheless true, but only partially describe the climate of the vast Northwest Territories. Optimists stress the warm temperatures and long summer days, while pessimists point to the long cold winter, lack of precipitation, and frequent summer frosts.

The individual is apt to become confused when these various facts are thrust upon him without adequate explanation. He often wonders, "How cold is it?" or "Is there really a summer in the Arctic?". When the United States Army Engineers arrived at Fort Smith on the southern boundary of the Territories, in 1942, they asked, in all

*Prepared at the Bureau of Northwest Territories and Yukon Affairs, Lands, Parks and Forests Branch, Dept. of Mines and Resources, Ottawa.

**The author wishes to acknowledge the assistance of A. J. Connor, Climatologist with the Meteorological Service, Dept. of Transport, Toronto.

Cover:—Penny Highlands, Baffin Island Photo by J. Whitley—from *Aurora Borealis* by A. G. Thompson







At top:—Meteorological station at the airfield at Hay River, Northwest Territories

Above:—Ionosphere research station and United States weather station (right) at River Clyde, Baffin Island

Photo by P. D. Baird

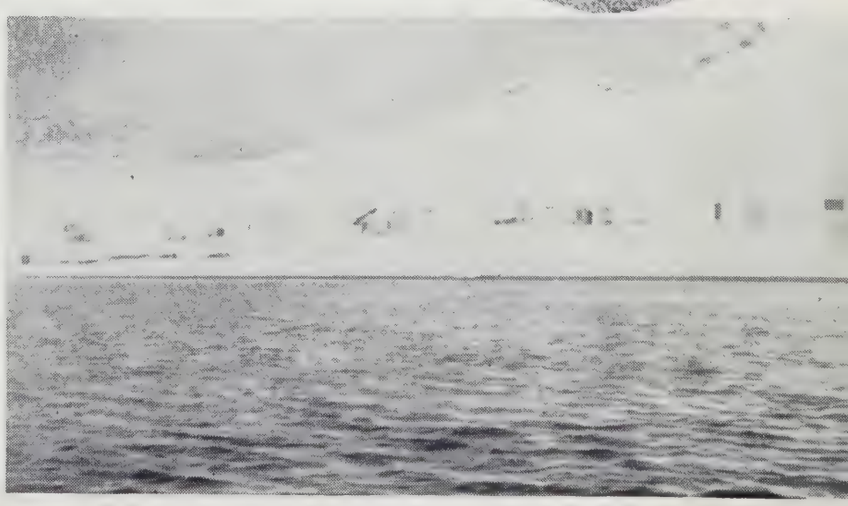
seriousness, how close they were to the North Pole. When they were informed that the North Pole was as far north of them as Los Angeles was south, they felt sure that these Canadians had never seen a map. Such false impressions are not restricted solely to people outside Canada, for many Canadians, too, have hazy ideas as to the climate of their country's northern regions.

In order to obtain authentic information regarding climatic conditions in northern Canada, the Canadian Meteorological Service, Department of Transport, and Royal Canadian Corps of Signals have established meteorological stations throughout our Northland. Many of these stations, consisting of lonely groups of buildings far from other white settlements, are serviced but once a year by ice-breaker. Their scattered locations are necessary in order that daily



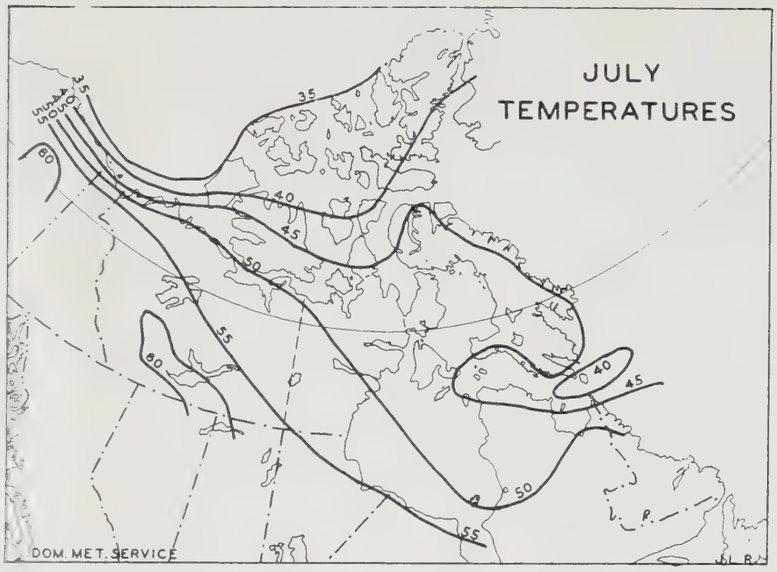
Above:—Settlement of Fort Providence, Northwest Territories — the Royal Canadian Corps of Signals meteorological station is in the lower right corner.

Right:—Husky dog in Mackenzie Valley; he is the dependable means of winter transportation between the various settlements.



Right:—Arctic Bay in winter—Canada's most northerly meteorological station

Dept. of Transport photo



atmospheric conditions may be measured and this information transmitted by radio to the more southerly stations. Since the weather in central North America moves from west to east, and is caused partially by the interplay of air masses from northern Canada and the Pacific Ocean, weather prediction (e.g., frost danger and precipitation) is strengthened by data regarding northern air mass movements and their characteristics. Nearly all transportation in the Northwest Territories, whether by plane, boat or dog-team, is largely dependent upon weather conditions, and the trust which transport officers place in the weather prediction of their northern stations is a just tribute to the valuable work which these men perform.

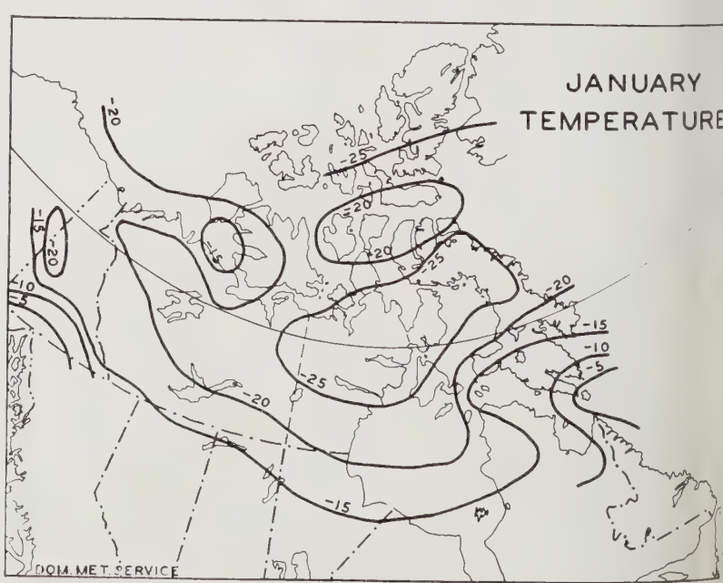
Climatic Regions

Since the Northwest Territories are so vast, temperatures vary greatly from place to place within the same season. This difference is marked enough each year to enable the area to be separated into two major climatic regions.(1) The northeastern region, including all the islands of the Arctic Archipelago, has a true Arctic climate, as defined by climatologists. The region north of a line extending roughly from the mouth of the Mackenzie River to Churchill, Manitoba, on Hudson Bay, is characterized by a climate in which the average temperature of the warmest month is *less* than 50°, but more than 32°.* Average winter monthly temperatures are all *below* 32°. The remainder of the Northwest Territories and Yukon has a sub-Arctic climate, in which the average temperatures of the coldest months are *below* 32°, but average temperatures of the three summer months are *above* 50°. Thus, the chief distinction between these two climatic regions is not in the winter, when both are cold, but in the summer, when the western areas are much warmer. (See map of July temperatures.)

The accompanying climatic map shows that the Arctic areas of Canada extend far south of the Arctic Circle (the incorrect limit of the Arctic in the popular conception), and Arctic conditions prevail as far south as latitude 57 degrees on the Hudson Bay coast of northern Quebec, and latitude 61 degrees on the west coast of the Bay in Keewatin District. Conversely, the sub-Arctic climate of northwestern Canada extends as far north as Aklavik, latitude 68 degrees, about 110 miles north of the Arctic Circle.(2) The climate of the Canadian Northwest is, therefore, similar to that which is found in Ontario north of Lake Superior and in Quebec north of the Gulf of St. Lawrence.

Climatic Controls

In order to understand the reason for climatic differences one has to be familiar with the various climatic controls that determine what type of weather may appear over a region. This is the work of the climatologist, who studies the kinds of air masses



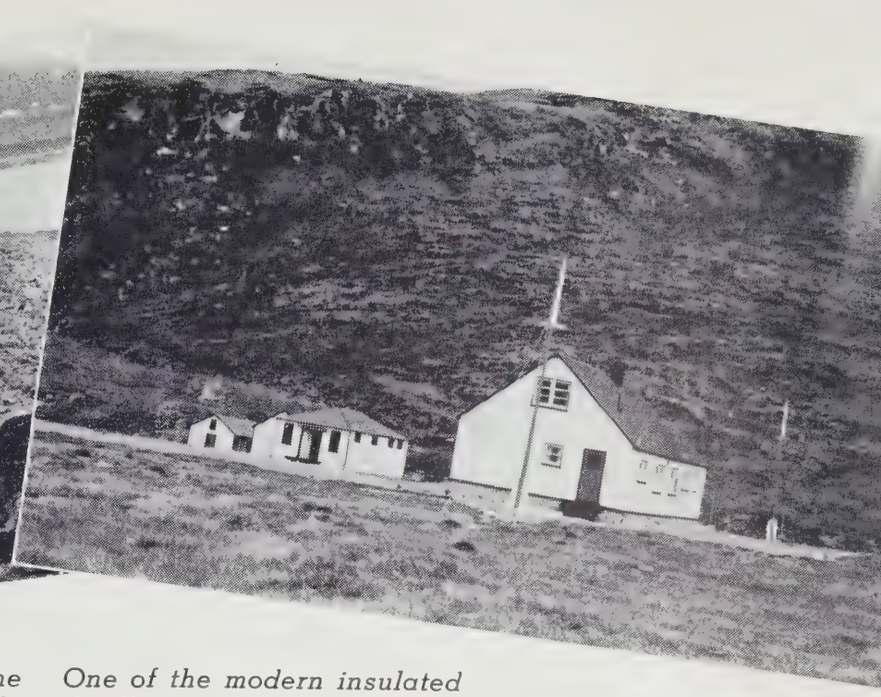
*All temperature readings throughout this article are given in Fahrenheit degrees.

(1) *The Northwest Territories—Administration, Resources and Development*, Bureau of Northwest Territories and Yukon Affairs, Dept. of Mines and Resources, Ottawa, 1944 (p. 12)

(2) "Land Use Possibilities in Mackenzie District, Northwest Territories", *Canadian Geographical Journal*, July, 1945 (p. 35)



Eskimo summer tents on the rocky beach at Cape Dorset, Baffin Island. Daily summer temperatures range from 50° to 60° here.



One of the modern insulated dwellings of the Hudson's Bay Company at Sugluk, on Hudson Strait. These homes are excellently furnished and usually heated with coal brought in on the annual supply ship.

which move over or near the area concerned, considers such geographic factors as latitude, topography, and distribution of water bodies, which influence the atmosphere, and averages the day-by-day weather records over a period of time to present a generalized picture of the usual weather conditions.

The layman may feel that this is too complicated for him to follow, but actually the weather and climate of a region result from known climatic controls. The usual weather is caused by the commonly occurring air masses which pass over the area, while the possible changes are limited by the types of air which *may* reach the region. Once the source regions and usual paths of the air masses are known, weather observers have only to record the air-mass properties and plot their movements on weather maps.

Modern meteorology is founded on the concept of air masses.[3] An air mass is defined as a huge body of air (from 100 to 500 miles in diameter) whose physical properties at its source (notably temperature and humidity) are more or less uniform horizontally. Regions of the earth where air masses stagnate long enough to gain definite properties are known as source regions. From time to time air masses which form in northern source regions move southward and join the generally eastward movement of air in mid-latitudes. They move across southern Canada and northern United States, being modified rapidly in summer and more slowly in winter by contact with the land. The kinds of weather occurring along the way will be partially due to the type of air mass and its degree of modification. In general terms, a cold dry air mass brings cool, dry, sunny weather, and a warm moist air mass is characterized by moderate, and usually cloudy, weather. At the boundaries between air masses of different types rainy or snowy weather is common.

Northern Canada is influenced by air masses from five chief source regions, and the seasonal properties of these air masses largely determine the type of climate.

	Source Characteristics	
Source Region	*Winter*	*Summer*
Arctic Ocean West	Very dry, cold	Dry, cool
Arctic Ocean East	Slightly moist, cold	Slightly moist, cool
Bering Sea	Lower layers moist, moderate cold	Moist, cool
North Pacific Ocean	Lower layers quite moist, mild	Moister than in winter Cooler than air over continent
North Atlantic	Moist, cool	Moist, cool

(Polar air which has left North America and returns as an easterly wind)

Cold air from the Arctic Ocean moves southward over continental Canada, being unhindered by topographic barriers, and is commonly found along the surface at all seasons. Air from other sources will generally be found aloft over the Territories,

(3) *Meteorology of the Canadian Arctic*, Dept. of Transport, Meteorological Division, Toronto, 1944

advancing eastward above the heavier continental air, and in these cases mountain barriers will prevent the moist lower layers of North Pacific and Bering Sea air from reaching the Territories. When the continental air (which originally came from the Arctic Ocean) moves eastward rapidly, there may be an opportunity for the drier top layers of Pacific air to descend to the surface of northwestern Canada, causing a sharp rise in temperature. At all seasons, polar air which has been warmed over the continent may return northward on the westward side of a circulatory wind system, bringing comparatively moist and warm air into the Northwest.

Depending upon how dominant are the Arctic air masses, the winters of the Northwest will be moderately cold or extremely cold, and will vary from year to year. For example, Fort Good Hope had an average mean monthly temperature for February, 1925, of −33°, while February, 1920, averaged above zero.[4] Similarly, Dawson City, Yukon, averaged lower than −43° during January, 1909, and yet recorded an average mean monthly temperature of +7° in January, 1926. Thus, northwestern Canada can be as cold in winter as the coldest parts of northeastern Siberia, or as mild as the Upper Ottawa River Valley.*

During mid-winter the Eastern Arctic is under the influence of polar air masses which move almost continuously southeastward from the Arctic Ocean towards Manitoba and James Bay. Relatively warmer air masses occasionally swing northwestward from the Labrador Coast to southeastern Baffin Island, but the Eastern Arctic is too far east to be influenced by warm Pacific air. Thus, one of the factors making the Eastern Arctic differ climatically from other parts of Canada is the continuity of cold periods. An extreme example was recorded in 1923-24 at Pond Inlet, Baffin Island, when the temperature remained continually below zero for 85 days, and for 28 days of that period the temperature fell to −40° or lower at some time during each day.

The Eastern Arctic has a large amount of cold water, including vast Hudson Bay, within its boundaries, and this is an important factor causing its summer climate to differ from that of the northwestern region.[5] In addition, the general movements of ocean currents through the Arctic Islands is eastward from the Arctic Ocean and southward towards Labrador, so that

(4) Connor, A. J., "The Temperature and Precipitation of Northern Canada", *Canada Year Book*, 1930 (p. 47)
(5) "Physical Geography of the Canadian Eastern Arctic", *Canada Year Book*, 1945 (p. 12)

* At the stations of the Dominion Meteorological Service the highest and lowest temperature in each 24 hours, termed respectively the maximum and minimum, are recorded by self-registering thermometers. For any month the sum of the daily maxima, divided by the number of days of the month, is the mean daily maximum temperature of that month. The mean minimum temperature is obtained in a similar manner. The half-sum of the mean maximum and the mean minimum is called the mean monthly temperature. The averages of these results for any particular month over a period of years are the average mean monthly temperatures

The highest and lowest temperatures during the total number of years of recording are termed the extreme maximum and extreme minimum. The latter figures are, of course, not usual, and differ from the average monthly maximum (or minimum) which is obtained by averaging the sum of each monthly extreme maximum (or minimum) for a particular month over a period of years.

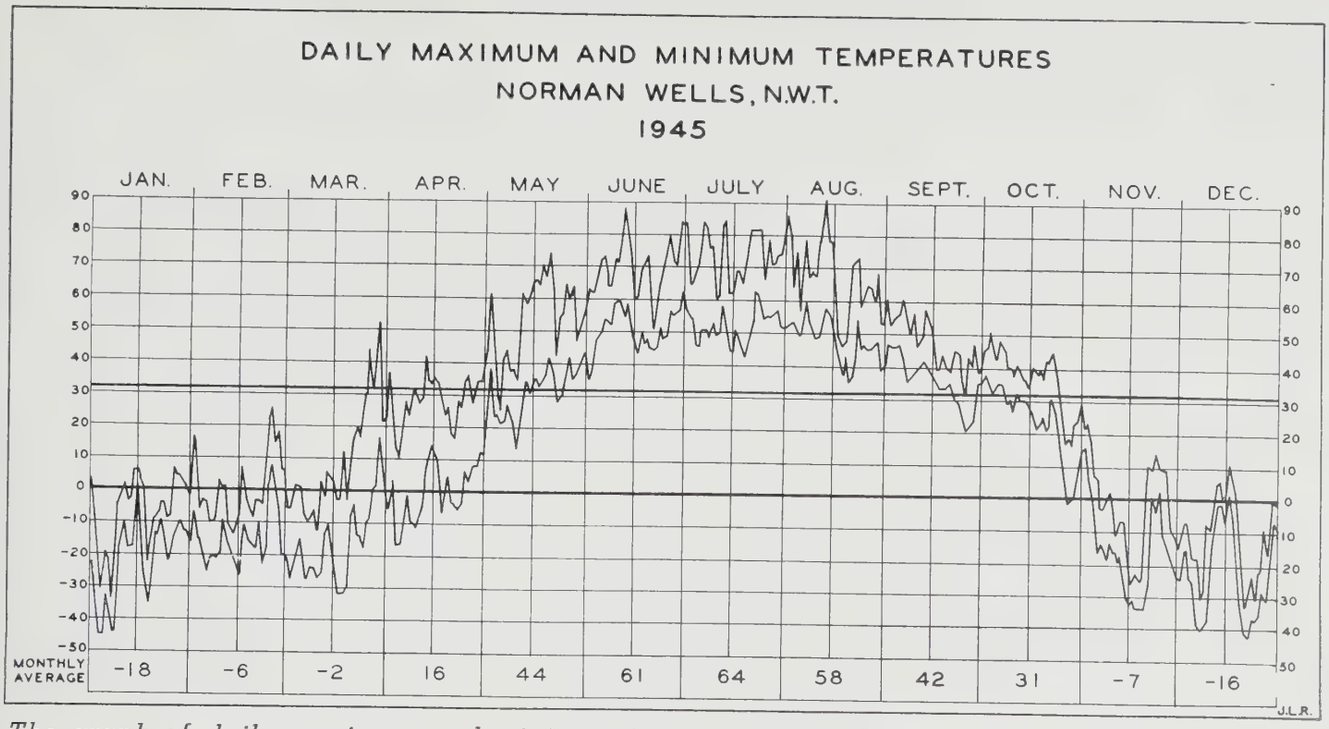
Bottom left:—The barren, rocky interior of southern Baffin Island. No agriculture is possible in this area. Patches of snow still remain in mid-July.

Below:—Ice-floes delay summer transportation in Hudson Strait. Massed floes block Wolstenholme harbour in mid-July, and annual supplies must be landed at a later second call.

Photo by F. Sparks







The graph of daily maximum and minimum temperatures at Norman Wells in 1945 illustrates the variations in temperature which may occur within a month. For example, although March had a monthly average of —2°, a temperature of over 50° was recorded in the month. The periodic movement of warm air masses over the region is graphically shown by the peaks recording high temperatures.

the waters are kept continually cold, hovering around 32° in Hudson Strait during the summer. Most students have performed the experiment which proves that soil loses temperature more rapidly than does water and that, similarly, its temperature rises faster. Continental land masses react in the same manner by cooling off rapidly in winter and heating up rapidly in summer, while land masses near large water bodies do not become as cold nor heat up as rapidly.

Winter Temperatures

As a result of its interior continental location, the lowest minimum temperature in Canada has been recorded at Fort Good Hope, in Mackenzie District. This temperature was –79°. Temperatures lower than –70° have been known north of Edmonton, Alberta, and Prince Albert, Saskatchewan. Extreme minimum temperatures of –67° have been recorded at three Yukon stations, and –65° has occurred in northwestern United States. There are probably colder places in the Yukon Mountains or on the Canadian Shield between Great Bear Lake and Hudson Bay, but no weather stations have been maintained there. Compared with these figures, the record low of –60° at Pond Inlet, Baffin Island, and Chesterfield, Keewatin District, belies the popular reputation of the Eastern Arctic as having the coldest temperatures in Canada. At other Eastern Arctic posts the lowest temperatures recorded are about –50°.(6)

Although extreme minimum temperatures in the Eastern Arctic are not as low as those of the interior area of northwestern Canada, it is, in reality, the coldest part of Canada on a monthly average. Winter begins in late September and lasts a full eight months. For three or four months of this time mean monthly temperatures range from –20° to –30° at the northern Eastern Arctic posts, and February is generally the coldest month. In the Hudson Bay and Hudson Strait area monthly averages vary from 0° to –20° for four months of the winter (10 to 20 degrees *warmer* than the same latitude in the Mackenzie Valley), illustrating the moderating effect of the relatively warmer air masses from the North Atlantic. (See map of January temperatures.)

In the Mackenzie Valley, January is the coldest month and monthly winter temperatures have an average of –15° to –23°.

(6) *An Outline of the Canadian Eastern Arctic. Its Geography, Peoples and Problems*, Bureau of Northwest Territories and Yukon Affairs, Dept. of Mines and Resources, Ottawa, 1944 (p. 8)

(Ottawa has a January mean of +15°.) These figures show that over a long period of time the region is much colder than the January mean average of −3° in Winnipeg, Manitoba, where mild spells raise average temperatures. Chinook thaws occasionally occur east of the Mackenzie Mountains but are not common. In such cases, air descending from the mountains heats rapidly, and at Aklavik on December 6, 1928, for example, the temperature rose from −5° to +54° within six hours.(7)

Although winter temperatures are undoubtedly cold in the Northwest Territories, man is combating his environment by utilizing scientific principles of heating. Modern houses for permanent residents of the area are soundly built and well insulated to withstand the severest cold. The mining companies provide comfortable heated dwellings with hot and cold running water for all their employees, and usually have a variety of indoor recreational facilities. In the Mackenzie Valley, in particular, ample fuel oil from near-by Norman Wells is a cheap source of efficient heat. Truly, the modern resident of the Territories no longer suffers the hardships from cold which were braved by early pioneers—he is warm when inside, and when outside about his duties he, unlike the people of our city civilization, is dressed suitably and warmly.

Despite our pride in technological advances in winter dwellings and clothing, we have to bow to the intelligence of the hardy Eskimo who, centuries ago, learned the principle that a closed dome of snow-blocks with an interior raised platform and low openings for ventilation was the most efficient method of heating with very little fuel. The Eskimo also learned that the warmest clothing came from the hides of the animals of the same environment, and modern residents of the Arctic still wear this type of winter clothing when travelling.

Arctic Night

Every schoolboy thinks of the Arctic as a place of six months' darkness and six months of continual daylight. Actually, the geographic North Pole is the only place which has six months with the sun below the horizon, and the length of the period of 24-hour darkness is reduced progressively southward to the Arctic Circle, where there is only one day in the year when the sun is not visible. The appeal of the "land of the midnight sun" has been caught and vividly described by an explorer on Ellesmere Island.(8)

"The period of so-called Arctic night begins on October 21 when even at noon-day the sun does not rise above the horizon in the due south. After the sun has first disappeared it lights the southern sky quite brightly for several hours each day, but this daily period of twilight rapidly shortens and grows fainter, until by mid-November only a noonday flush indicates south. Even this soon fades away and for almost two months Ellesmere Island is a land of darkness.

"This Arctic night is not so dark nor so disheartening as the imagination of temperate and tropical peoples is wont to picture it. For ten or twelve days of every month the moon circles the sky; the brilliant stars revolve around Polaris almost at the zenith, and the light from the moon and stars is reflected from the glittering snow-and-ice fields.

"Then about mid-January the soft rose and gold of the noonday flush reappears on the southern horizon and waxes longer and brighter each day until at noon on February 21 the upper limb of the sun, large and red, gleams soft and bright above the southern horizon for a few moments. The sun has come back. The long night is over. The next day the whole sun appears, and seems to roll along the horizon a few degrees for a few minutes; the next day it has risen quite above the horizon and covers an arc of several degrees; in the next few days the time and the arc lengthen fast.

"The time of sunshine lengthens each day, and night grows lighter, until on April 21 there is no sunset. The sun merely dips down to the horizon due north at midnight, and begins at once to rise to another circle a little higher than the day before. Day by day the sun rises in the sky until in mid-

(7) Koeppe, C. E., *The Canadian Climate*, Bloomington, Ill., 1931 (p. 104)

(8) Ekblaw, W. E., *The Polar Eskimo; Their Land and Life*, Clark University, Worcester, Mass., 1926



At top:—Settlement at Aklavik after an early autumn snowfall

Photo by D. B. Marsh



Above:—Department of Transport meteorological station at Coppermine on Coronation Gulf. Important weather information is transmitted daily by radio to more southerly stations for forecasting purposes. Dept. of Transport photo



Above:—Royal Canadian Corps of Signals station at Fort Norman in centre, Doctor's residence at right, scenic Bear Mountain in background

June the full glory of Arctic day floods the whole top of the world within the Arctic Circle."

Summer Temperatures

The greatest climatic difference between the Eastern Arctic and northwestern Canada appears during the summer. This difference, which is also evident in resources, development, and peoples, can be directly traced to the climatic controls which give the two regions separate characteristics.

It is generally believed that the warm summer temperatures of the Mackenzie Valley are due to the long hours of daylight.* Undoubtedly the long daily period of solar insolation helps to stimulate the growth of garden crops, but since, as shown by the following table, places of the same latitude in the Eastern Arctic (having,



Winter clothing of caribou skins worn by the Eskimo—designed to give maximum warmth and freedom of movement. River Clyde, Baffin Island. Photo by S. Hluckan

*A chart showing the number of hours of summer daylight each month at the Mackenzie Valley settlements will be found in reference(2).

therefore, an equal number of daylight hours) do not record the same warm summer temperatures, there must be other contributing factors.

July Temperatures

Latitude	*Western*		*Eastern*	
60	Fort Smith	60°	Churchill	53°
			Cape Hopes Advance	41°
65	Fort Norman	60°	Chesterfield	48°
			Pangnirtung	45°
69	Aklavik	56°	Cambridge Bay	49°
			Pond Inlet (lat. 73)	42°

There are two major reasons why summer temperatures do not rise in northeastern Canada, resulting in Arctic rather than sub-Arctic conditions there: the Eastern Arctic is dominated by cool Arctic air masses during the summer, and the area contains large bodies of cold water whose temperatures rise slowly, militating against any rapid warming of the lower layers of Arctic air.

The present Eastern Arctic stations, all located on the coast where water transport can serve them, record extreme maxima only in the 70's, and the highest known recordings are 84° at Chesterfield Inlet and 81° at Lake Harbour and Cape Hopes Advance, on Hudson Strait. It is no doubt possible that higher summer temperatures may occur in certain low interior areas. Average daily maxima in the cool 50's are the usual summer temperatures of the Eastern Arctic, where a July average mean temperature is similar to an early April mean temperature near Vancouver, British Columbia.

The Eastern Arctic does have a summer, however, during which the snow disappears for three or four months. Grass comes to life in the valleys and lowlands which contain soil, and flowers blossom forth in colourful beauty. Ducks and geese crowd their summer nesting grounds after long flights from the south, and myriad mosquitoes swarm over the low wet areas. In Hudson Bay and Strait the sea-ice begins to break up in late June and is joined by the ice from Foxe Basin in the general drift of currents through Hudson Strait to the North Atlantic. During much of July the Strait remains non-navigable as the ice moves outward, being hastened by westerly winds or delayed by easterly winds. Towards the end of October or early November the

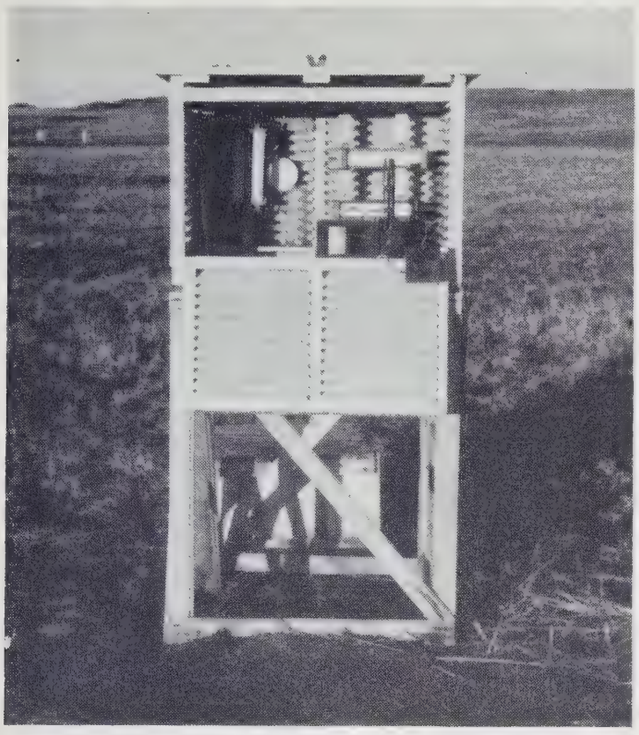


Group of gardens in the Mackenzie Valley

Right:—A commercial garden at Yellowknife

Below: — Hudson's Bay Company garden at Fort McPherson, 80 miles from the Arctic Coast

Bottom right: — Anglican Mission garden at Fort McPherson. Note the greenhouse in background.



Instrument shelter where the atmosphere's phenomena are recorded at all meteorological stations. Dept. of Transport photo

sea-ice again begins to form and will build out from the shores for a distance of five to seven miles, finally reaching a mid-winter thickness of about five feet.

In the Mackenzie Valley, the land mass heats up more rapidly in spring, despite the large number of lakes, and under the influence of warm air from the North Pacific some days may become quite hot during the summer. Average daily temperatures rise above the freezing point in late April and early May. At the stations along the south shore of Great Slave Lake and near the Arctic Coast, daily spring temperatures in May and June will depend greatly upon wind direction. A south wind will bring warm weather for a few days, while a north wind from the ice-covered lake or Arctic Coast will be cold. During the period of break-up and freeze-up there is a space of about three weeks in both spring and autumn when climatic conditions limit transportation.* Planes have to change from ski to float equipment, and after break-up local dog-team travel is replaced by small boats and canoes.

During the three summer months of June, July and August average mean monthly temperatures range from 50° to 60°. Extreme maximum temperatures of 90° or more (Fort Smith 103°) have been recorded at all stations except Aklavik (88°), but monthly maximum temperatures of 80° to 85° are more usual.

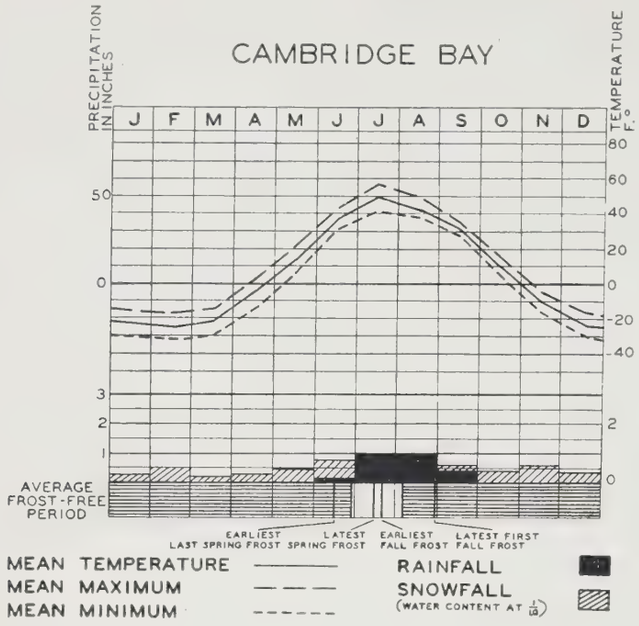
Summer in the Mackenzie Valley is really a very pleasant season. The days are warm and usually bright, and ordinary light summer clothing is customary. With daily temperatures above 70° and night temperatures above 45° in July during the growing season, it is not strange that the usual garden vegetables are raised in sufficient quantities for local use at all settlements as far north as Aklavik. In years without early frosts wheat will ripen as far north as Fort Simpson, and sometimes even beyond there.

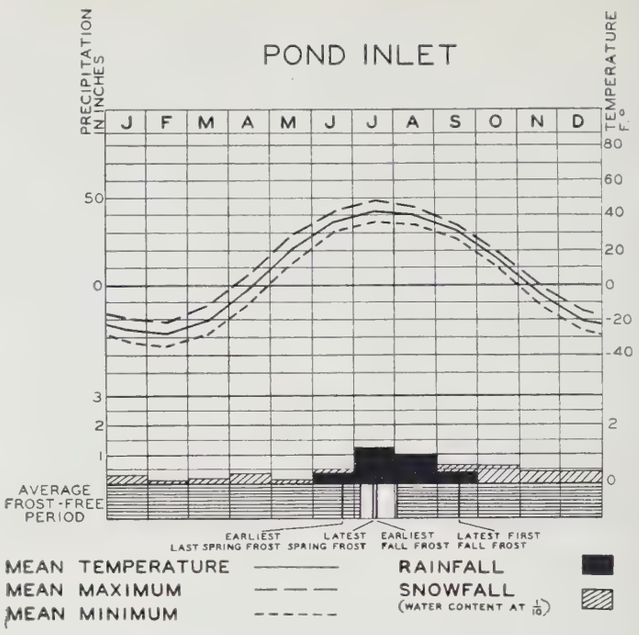
Generalizing about summers in northwestern Canada is a dangerous practice because they differ in character from year to year, depending upon the dominant movement of Arctic air masses. If these air masses follow their typical southeasterly summer course over Foxe Basin, warm Pacific air entering from the west or south will raise Mackenzie Valley temperatures, but if the cool air masses maintain a more westerly course, the season may be rather cool. Because of this occasional latter condition, July extreme minimum temperatures ranging from 26° to 31° have been recorded at nearly all Mackenzie Valley stations and August minima of 18° to 24° are known at each place.

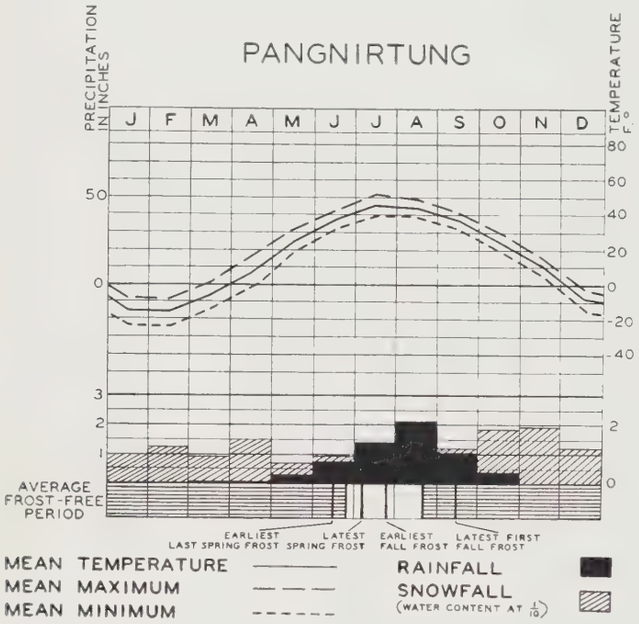
Northern Arctic Islands

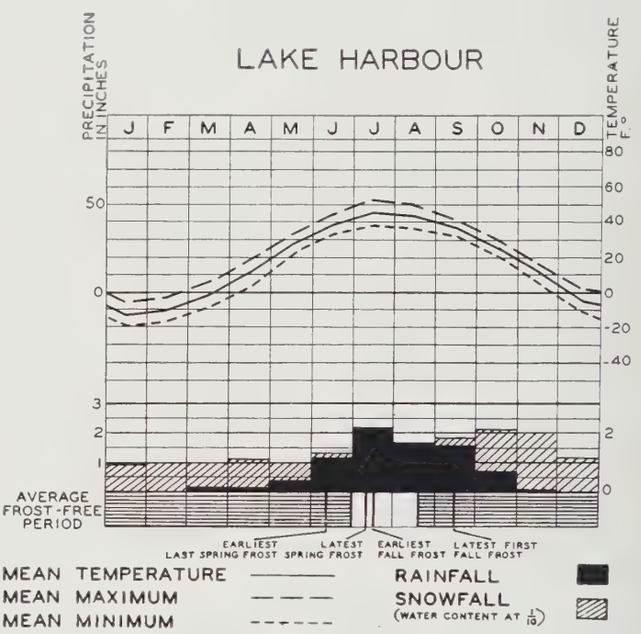
Temperatures recorded in the farthest north group of Canadian Arctic Islands, on which no one lives at present, are more typical of those which are generally, but incorrectly, attributed to all of northern Canada. Meteorological data for this area are scanty, being supplied chiefly from the R.C.M.P. detachments' and explorers' records, but they indicate that January mean temperatures average from –25° to –35° and that July monthly means seldom rise above +40°.

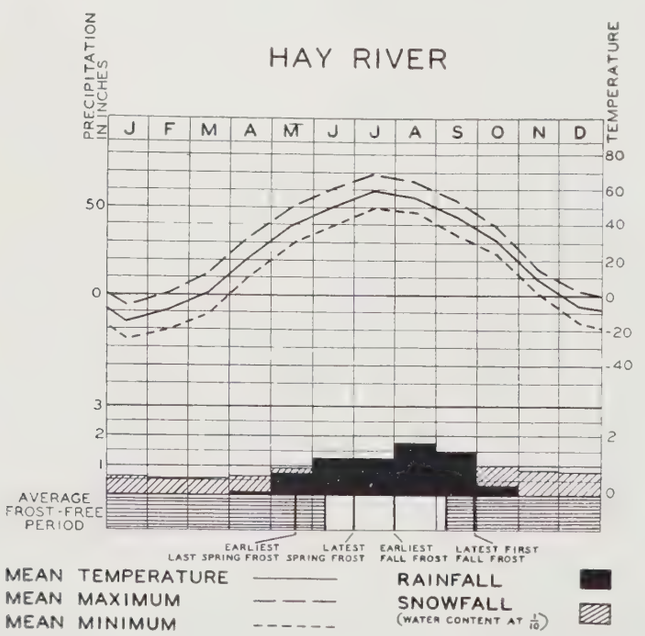
*For more detailed information on transportation see "Water Transportation in the Canadian Northwest", *Canadian Geographical Journal*, November, 1945.

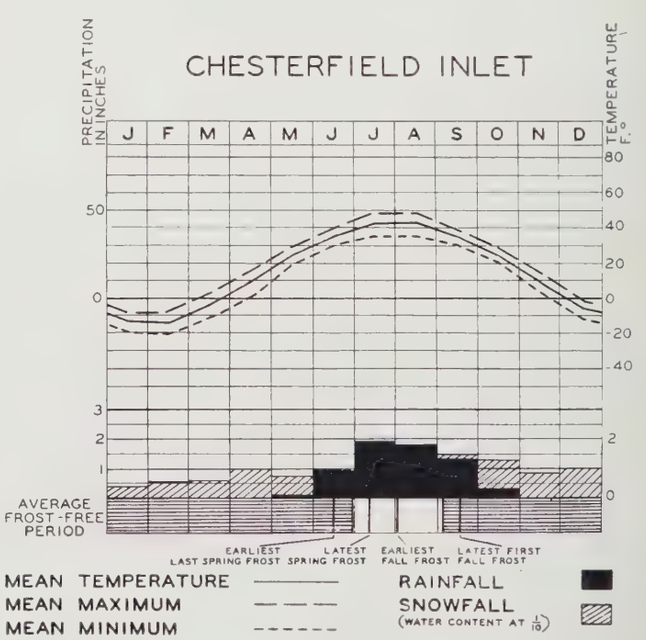

CAMBRIDGE BAY
PRECIPITATION IN INCHES
TEMPERATURE F.°
J F M A M J J A S O N D
AVERAGE FROST-FREE PERIOD
EARLIEST LAST SPRING FROST
LATEST SPRING FROST
EARLIEST FALL FROST
LATEST FIRST FALL FROST
MEAN TEMPERATURE
MEAN MAXIMUM
MEAN MINIMUM
RAINFALL
SNOWFALL
(WATER CONTENT AT 1/10)


POND INLET
PRECIPITATION IN INCHES
TEMPERATURE F.°
J F M A M J J A S O N D
AVERAGE FROST-FREE PERIOD
EARLIEST LAST SPRING FROST
LATEST SPRING FROST
EARLIEST FALL FROST
LATEST FIRST FALL FROST
MEAN TEMPERATURE
MEAN MAXIMUM
MEAN MINIMUM
RAINFALL
SNOWFALL
(WATER CONTENT AT 1/10)


PANGNIRTUNG
PRECIPITATION IN INCHES
TEMPERATURE F.°
J F M A M J J A S O N D
AVERAGE FROST-FREE PERIOD
EARLIEST LAST SPRING FROST
LATEST SPRING FROST
EARLIEST FALL FROST
LATEST FIRST FALL FROST
MEAN TEMPERATURE
MEAN MAXIMUM
MEAN MINIMUM
RAINFALL
SNOWFALL
(WATER CONTENT AT 1/10)


LAKE HARBOUR
PRECIPITATION IN INCHES
TEMPERATURE F.°
J F M A M J J A S O N D
AVERAGE FROST-FREE PERIOD
EARLIEST LAST SPRING FROST
LATEST SPRING FROST
EARLIEST FALL FROST
LATEST FIRST FALL FROST
MEAN TEMPERATURE
MEAN MAXIMUM
MEAN MINIMUM
RAINFALL
SNOWFALL
(WATER CONTENT AT 1/10)


HAY RIVER
PRECIPITATION IN INCHES
TEMPERATURE F.°
J F M A M J J A S O N D
AVERAGE FROST-FREE PERIOD
EARLIEST LAST SPRING FROST
LATEST SPRING FROST
EARLIEST FALL FROST
LATEST FIRST FALL FROST
MEAN TEMPERATURE
MEAN MAXIMUM
MEAN MINIMUM
RAINFALL
SNOWFALL
(WATER CONTENT AT 1/10)


CHESTERFIELD INLET
PRECIPITATION IN INCHES
TEMPERATURE F.°
J F M A M J J A S O N D
AVERAGE FROST-FREE PERIOD
EARLIEST LAST SPRING FROST
LATEST SPRING FROST
EARLIEST FALL FROST
LATEST FIRST FALL FROST
MEAN TEMPERATURE
MEAN MAXIMUM
MEAN MINIMUM
RAINFALL
SNOWFALL
(WATER CONTENT AT 1/10)

Frost-free Period

Evening temperatures fall below the freezing-point occasionally in mid-August in the Northwest Territories, but the occurrence of first autumn frosts varies a great deal, depending upon local topographic conditions and air-mass movements. In both the eastern and western parts of the Territories, average first autumn frosts are recorded any time between early August and early September, and an occasional early frost has been recorded in July at each station. Frosts are caused by a cold air mass descending upon the region. If the cold air has been preceded by a warm, moist air mass, however, the low clouds which form will decrease the usual amount of evening cooling and the frosts will not occur. The chief difference in frost-free period between the eastern and western part of the Territories occurs in the spring; the Mackenzie Valley has its average last spring frosts in mid-June, while in the Eastern Arctic last spring frosts average late June or early July. (See accompanying climatic graphs.)

In the Mackenzie Valley the average frost-free period ranges from a minimum of 44 days at Fort Norman to a maximum of 92 days at Fort Resolution.[2] If one disregards early and late vagrant frosts and considers the growing season to be defined as the period during which mean daily minimum temperatures are above 32° and mean daily maximums above 43°, the Mackenzie Valley has an average growing season of 130 to 140 days. This period is about one month less than that recorded at the present northern limit of successful wheat growth in Saskatchewan.*

At the Western Arctic posts the frost-free period lasts from late June to early August, averaging 40 to 50 days in all. In the Hudson Bay region of the Eastern Arctic the frost-free period ranges from a maximum of 67 days at Chesterfield to 44 days at Port Harrison. The greatest hazard lies in the variability of first autumn frosts, which have occurred as early as August 2 and as late as September 17 at Chesterfield. The number of frost-free days at the Baffin Island settlements decreases northward from 48 days at Lake Harbour to 29 days at Pond Inlet.

Lack of agriculture in the Eastern Arctic is not only a result of frosts occurring in every month at most stations, but is also due to the lack of developed soil. Much of the area was scoured free of soil during the last Glacial Age, leaving typical bare-rock ridges. Where present-day streams have deposited soil in some of the valleys, the severity of the climate has prevented the collection of sufficient humus to encourage garden growth.

Precipitation

Average annual precipitation in the Northwest Territories is not high because the atmospheric conditions which cause precipitation do not often occur. In the first place, cold Arctic air does not contain as much water vapour as warm air. Secondly, these air masses, in moving southward, especially in summer, are becoming warmer rather than colder, and tend to absorb moisture rather than release it. Thus, in the Northwest Territories, precipitation usually occurs when warmer and moister air from the North Pacific (or North Atlantic, for the Eastern Arctic) enters the region and is cooled by rising over colder air masses from the Arctic. Since such warm air masses will already have lost some of their moisture in rising over the Rocky Mountains and Mackenzie Ranges, heavy precipitation will not be usual.

Rainfall

An annual average of 10 to 13 inches of precipitation is recorded at the Mackenzie Valley settlements, of which about forty to fifty per cent falls as rain during the four summer months. July is generally the wettest month, but this average of 1 to 2 inches of rain a month is scanty compared with the 2½ to 3 inches per month in agricultural regions like those in the vicinity of Ottawa, Toronto or Winnipeg.

Average precipitation is regionally distributed fairly evenly throughout the Mackenzie Valley, increasing slightly southward from 10 inches at Aklavik to 13 inches at Fort Smith. Agriculture in the Northwest

* Information compiled by A. J. Connor, Dominion Meteorological Service









Group of flowers in the Canadian Arctic

Upper left:—A field of Arctic cotton, Pond Inlet, Baffin Island

Upper right:—Mountain avens blooming at Bowman Bay, west coast of Baffin Island.

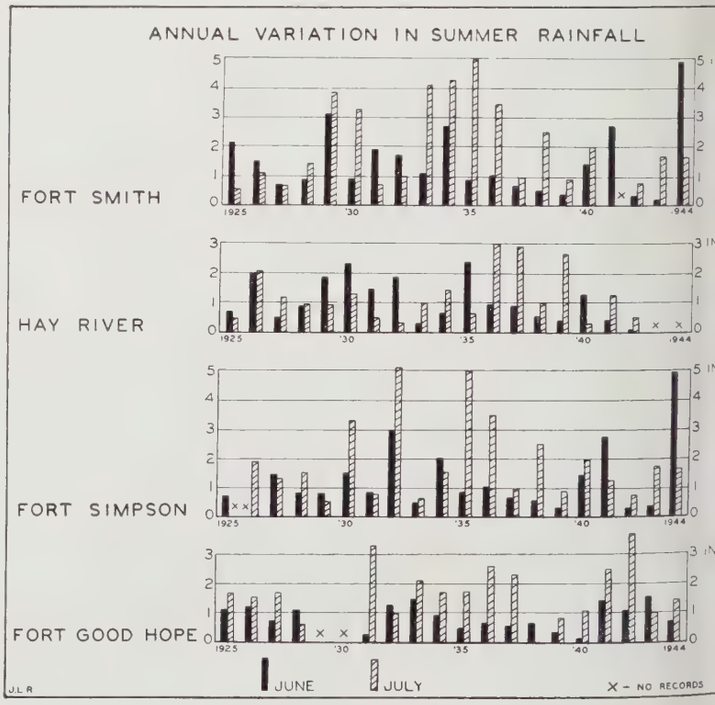
Left:—Arctic daisy in a grassy spot between rocks, Chesterfield Inlet

Right:—Lupins, north of Great Bear Lake

Dept. of Mines and Resources photos

is much concerned with the dependability of amounts which fall, as well as with averages. The accompanying chart illustrates that rainfall varies greatly from season to season, and even from place to place in the same season. Some stations have 3 or 4 inches of rain in one month of a year, and in the next year have less than 1 inch.

Rainfall is generally less in the Eastern Arctic and along the Western Arctic Coast (2 to 4 inches in a summer). Higher rainfall is recorded, however, in the southern Baffin Island and Hudson Strait areas, where 7 to 8 inches are deposited by moist winds from the south and east during the four summer months.



Snowfall

Snowfall is difficult to measure in northern Canada, where daily drifting of snow is quite common; the present records, especially in the Eastern Arctic, should be considered as only rough estimates. The Mackenzie Valley is often pictured as a region of deep snows, but the average of 40 to 60 inches of snow which falls there is actually similar to that which falls in Winnipeg (54 inches), and about half that which has been recorded in Toronto or Montreal. Snowfall is distributed fairly evenly throughout the winter months, and, because thawing is not usual, the snow may accumulate to a depth of 3 to 5 feet in the woods. Snowfall in the Mackenzie Valley is rare during June and August and (excluding Aklavik) is not known during July.

Snow falls chiefly during October and November in the Eastern Arctic, varying in amount from 30 to 60 inches at most stations. The southern Baffin Island stations again receive higher precipitation, recording 80 to 100 inches of snow. At most Eastern Arctic centres there is enough snow accumulated for dog-team travel after mid-November, although windy rock-ridges may remain bare all winter.

In the Arctic areas an occasional snow flurry has been recorded at most stations in July, and about a half-inch of snow is common in August. In general, in the Hudson Strait-Hudson Bay region, the land is free of snow during July, August and September. Farther north, in places along the northeast coast of Baffin Island, and most of the eastern sections of Devon and Ellesmere Islands, there are permanent snowfields and ice-caps which are, on a much smaller scale, similar to the permanent ice-cap of near-by Greenland.

Winds

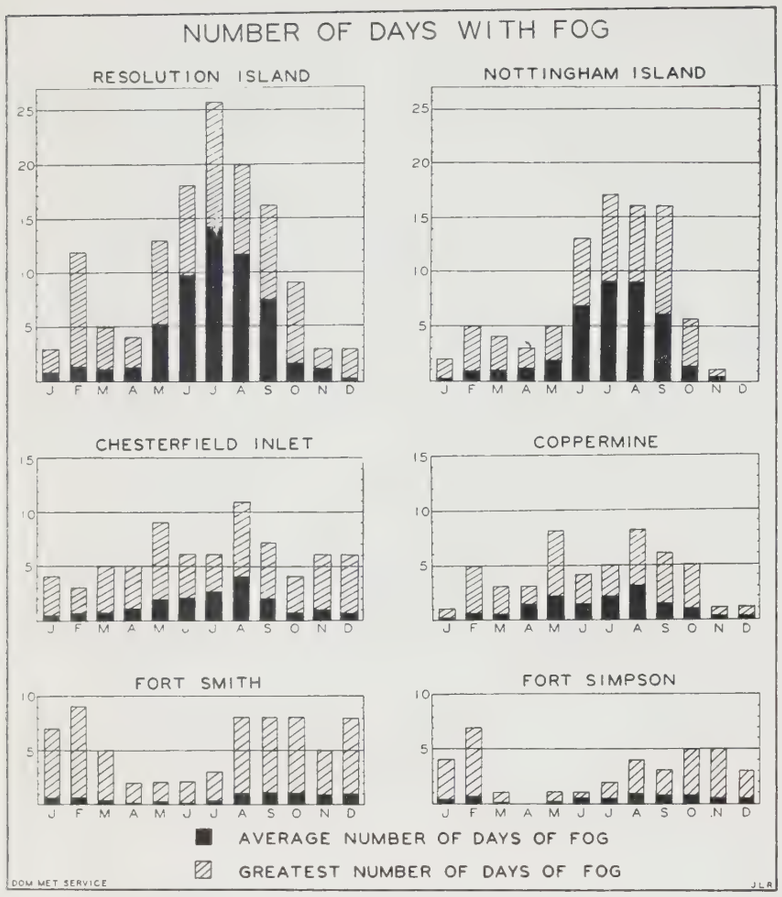
Prevailing wind directions are difficult to determine in the Eastern Arctic because most of the posts are located in sheltered areas where wind directions are controlled by some topographic feature. For example, Lake Harbour, located at the head of a 10-mile fiord extending northward into southern Baffin Island, shows a predominance of north and south winds, which may not be typical of the upland regions. In general, winter winds appear to blow chiefly from the north and northeast at the far-northern stations and from north and northwest in the Hudson Bay area. There is more variety in summer winds, due to the proximity of moving low-pressure air masses which sometimes follow a more northerly path from the Great Lakes across central Quebec in summer.

Arctic wind velocities are usually low during the summer and become stronger in the autumn and winter. Gales may last for several days during the winter, but, paradoxically, calms also occur most frequently in the winter when cold polar air masses stagnate over the region. Along certain steep Arctic coasts local winds of high velocity have been reported by exploratory expeditions. Cold air, from interior plateaux or mountains, being heavy, may descend rapidly to the water level, creating high velocities which will be felt for a few miles on either side of the coast.

In the Mackenzie Valley, winter winds blow predominantly from the northern and western quadrants. This is shown on the accompanying wind rose chart, which illustrates the percentage frequency of winds. Summer winds vary more in direction,



Fog rising from open water near loose ice-floes in Hudson Strait—an added hazard to July transportation.



notably in having an increase in the number of easterly and southerly winds, in addition to the prevailing north and west winds. Calms are fairly evenly distributed throughout the year, and occur in about 15 to 30 per cent of twice-daily observations.

Fog

The prevalence of summer fog is one of the hazards of water and air transportation in the Eastern Arctic. When relatively warm air masses from the land come in contact with the cold Arctic waters of Hudson Bay and the Arctic Islands, condensation occurs, causing fog and low clouds to be frequent.

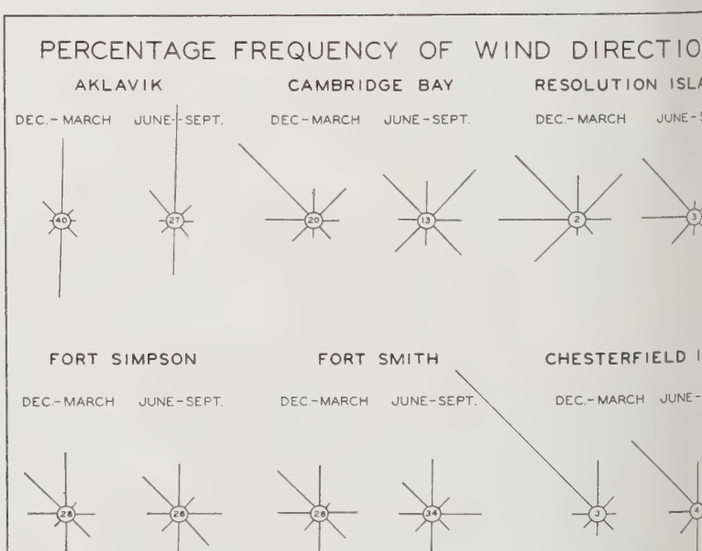
The accompanying fog charts show that July is usually the foggiest month. Fogs are fairly frequent in Hudson Strait during the summer, but are less common at the coastal stations of Chesterfield and Coppermine. Fogs occur less frequently at the Mackenzie Valley stations than at the coastal stations of the Arctic, although some months in the former region have recorded as many as eight days with fog.

Winter fogs are not usual at the present observing stations, where temperatures over the land and sea-ice are fairly equal. Local fogs, however, known as "sea-smoke", often occur over open water or at sea, and have been reported by winter travellers. Since relative humidity is fairly high in the Arctic, condensation may occur at any time when cooling air masses pass over the region. With this set of natural conditions, it is apparent that fog, which is a low-altitude form of condensation, will always be a problem hampering dependable transportation.

Ceiling and Visibility

Information regarding usual, and daily, ceilings and visibilities is of basic importance to air travel in northern Canada. All Department of Transport and Royal Canadian Corps of Signals stations in the Territories record these data as a daily service for the Royal Canadian Air Force and commercial companies. Much of the data, however, at present covers too short a period to present accurate averages.*

In preparation for aerial photography and mapping operations by the R.C.A.F. on the west coast of Hudson Bay, it was found that July was the clearest summer month which combined good visibility (horizontal distance from point of observation on the ground) with unlimited ceilings (clouds 10,000 feet or higher). March and April are clearer months for flying, but snow blankets



*Climatic data from each airport, if required for aviation, may be obtained upon request from the Meteorological Service of Canada.

the ground, making topographic features unrecognizable.

In Hudson Strait it is important for summer shipping to be familiar with the usual visibility which may be expected. At Nottingham Island, for example, there is an average of 23 days during each of the four summer months in which visibility is better than six miles at noon. This amount is slightly less at Resolution Island at the eastern entrance to the Strait. At all three stations, September to November has the highest percentage of good visibility, but unfortunately autumn storms are also more frequent during this period, hindering water transport.

Present air transportation is more concerned with facts describing ceilings and visibilities in Mackenzie District than with similar data concerning the Eastern Arctic. Recent hourly weather observations have been summarized for a short period and indicate that ceilings of over 10,000 feet are most common in August, but January and February have the highest percentage of cloudless days. Unlimited ceilings are less frequent during the autumn months of September to November.

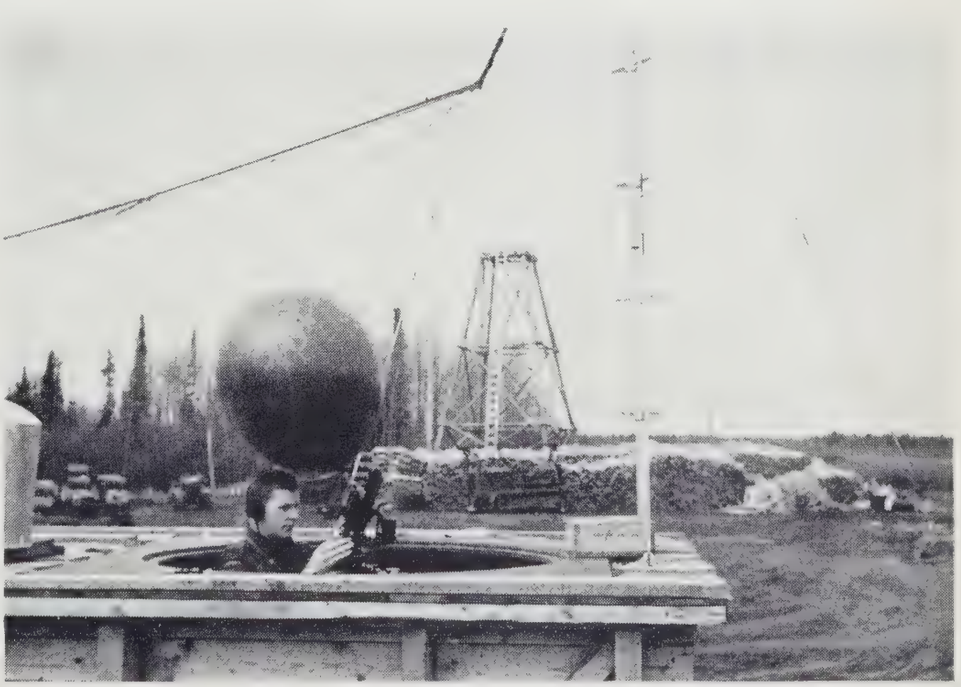
On the ground, good visibility increases during the spring and reaches a maximum in July and August, while visibilities are poorest during the months of November and December. In the clear days of spring, when bright sun and complete snow cover are combined, snow blindness is a serious problem for both natives and whites in the Arctic, unless snow goggles are worn.

Conclusion

Many misconceptions and mis-statements as to actual conditions and future possibilities of the Northwest Territories have been based upon an inadequate knowledge of climatic conditions. One of the causes of misunderstanding is undoubtedly the fact that the Territories comprise such a vast area (one-third of Canada) that the climate differs markedly from one region to another. The basic difference lies in the type and length of summer: the eastern areas are Arctic, but have a short, cool summer; the Northwest, despite its northern latitude, has summer periods often as warm as in more southerly parts of Canada.

It is undoubtedly true that the winters of the Northwest Territories are cold. They are not much colder in some regions, however, than in more densely settled sections of Canada, and improved heating techniques and insulated dwellings alleviate this disadvantage. Moreover, for many people the winters are definitely not uncomfortable, because the air is not damp, and the residents wisely dress warmly and suitably for low temperatures.

A knowledge of climate gives greater insight into the problems of the great Arctic and sub-Arctic areas of Canada. It helps to explain the difficulties resulting from ice conditions which hinder summer transportation, and the lack of agriculture to support an Eastern Arctic white population. In addition, if one appreciates that northwestern Canada is sub-Arctic, one realizes that man can carry on most of his usual activities as he does in more southerly regions. If resources are found which are rich enough to compete with those closer to present markets, climate will not be a principal obstacle impeding development of the Canadian Northwest.



Releasing a pilot balloon at the R.C.C.S. meteorology station at Hay River Airfield. The direction of upper air winds may be determined by the plotting of its course of ascent.



Low coast and sea-ice off Bear Peninsula, western Ellesmere Island
Photo by C. Vibe



"The Two Craters" on Cape Southwest, Axel Heiberg Island
Photo by C. Vibe



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BUREAU OF NORTHWEST TERRITORIES AND YUKON AFFAIRS
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Ottawa, Canada



FUR PRODUCTION in the NORTHWEST TERRITORIES



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The Hudson's Bay Company trading-post at Fort Simpson, N.W.T., with store (right), dwelling (left), warehouses and garden

Fur Production in the Northwest Territories*

by M. J. *and* J. L. ROBINSON**

GREAT CHANGES have taken place in the fur trade since the early days when it dominated all other pursuits and inspired the exploration which opened to colonization the vast country which is now Canada. The early exploratory history of the Canadian Northwest is primarily concerned with the movements of adventurers who penetrated farther and farther northward to tap the sources of furs. The Hudson's Bay Company, formed in 1670, was at first content to establish trading-posts on Hudson and James Bays and encourage the Indians to bring their furs down the rivers to the coast. The trade of the St. Lawrence Valley and Great Lakes region was in the hands of the French *voyageurs* who were pressing to the westward.(1)

After 1763 the rivalry between the two groups became very keen. Scotch traders began competing with the French from Montreal and expanded into the Northwest. The Hudson's Bay Company, finding that its furs were being diverted to the south, countered by also sending parties inland. Cumberland House, 230 miles from the mouth of the Saskatchewan River, was established in 1774 and became the distributing and collecting centre for the Company's interior trade. In 1784 the Montreal merchants combined to form the North West Company, and during the latter part of the eighteenth century fur-traders pushed to the Arctic and Pacific Oceans. In order to retain the trade of the new fur areas both companies established a network of northern posts and serviced them with large canoe brigades.

The North West Company was first to enter the Mackenzie Valley. Following

*Written in the Bureau of Northwest Territories and Yukon Affairs, Lands, Parks and Forests Branch, Dept. of Mines and Resources, Ottawa.

**The authors wish to acknowledge the assistance of officers of the Wildlife Division of the Lands, Parks, and Forests Branch, and the Fur Trade Department of the Hudson's Bay Company.

Alexander Mackenzie's historic trip to the Arctic, it mapped out fur areas and established posts at Fort Chipewyan (1789), entrance to Mackenzie River (1790), Lac la Martre (1793), 80 miles west of Great Slave Lake on Mackenzie River (1796), Great Bear Lake (1799 and again in 1804), Fort Simpson (1804), Fort Good Hope (1805), and Fort Liard (1805).[2] For the first time traders were in continuous contact with northern Indians and encouraged them to bring furs directly to their posts.

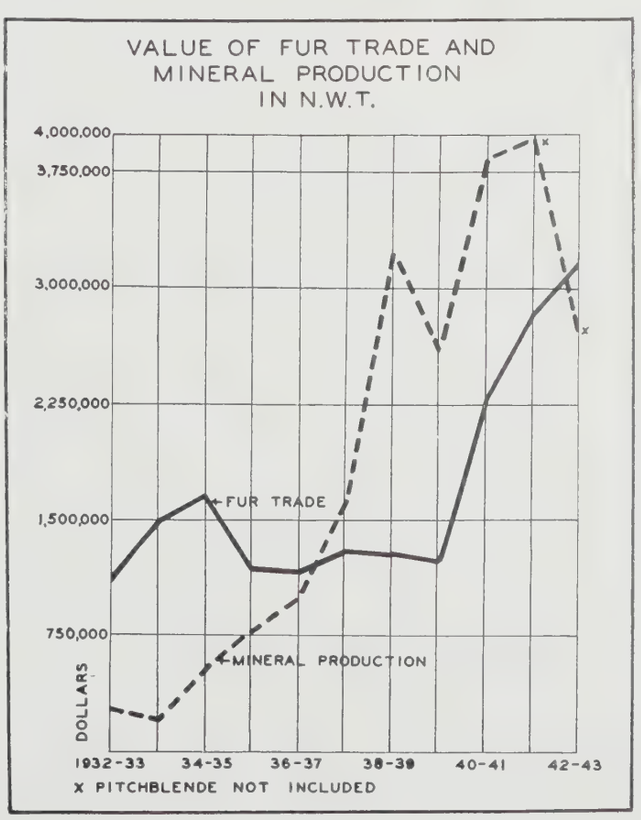
The Hudson's Bay Company attempted to match the expansion of its southern rivals and established posts on Slave River, 25 miles south of Great Slave Lake (1803), and on Moose Island in Great Slave Lake (1804). In 1806, however, the Company found that it could not meet the competition and withdrew from Athabaska District. A reorganization of the Company in 1810-11 resulted in renewed expeditions into the Northwest. Utilizing its short river supply route to Hudson Bay, the "Honourable Company" was able to regain its share of the fur catch. Finally, in 1821, the two competing companies amalgamated under the name of the Hudson's Bay Company and there followed a more orderly expansion.[3]

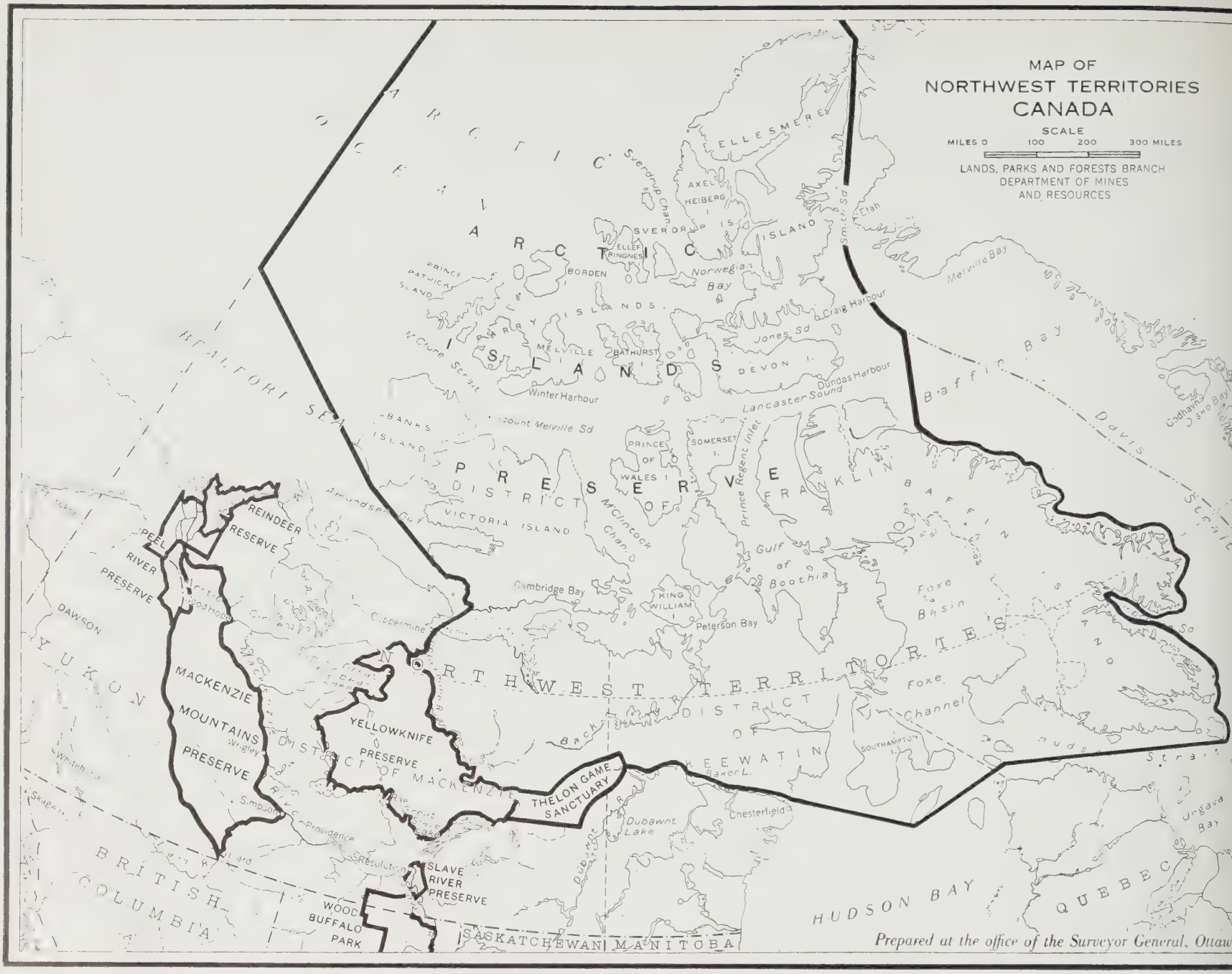
During the first half of the nineteenth century the Hudson's Bay Company had a monopoly of the trade of this large area of Canada in which fur was the only known resource. Throughout the period the post factors of the Company maintained various regulations aimed at conservation of many of the fur species and imposed definite restrictions which prevented overtrapping of others. In 1825 Indians were discouraged from hunting beaver during the summer, and in 1830 the catch for certain districts was restricted to the average for preceding years. In 1839 only large muskrat were accepted, and at some posts certain furs were refused over a period until their numbers increased locally. The rule of the Hudson's Bay Company ended in 1869 when Rupert's Land, comprising the vast woodlands and tundra of Northern Canada, was bought from the Company by the newly-federated Government of Canada.

Fur-laden ships had been passing through Hudson Strait for 250 years before the first trading-post was established in that area.[4] Beginning in 1909 at Wolstenholme, on the northwest corner of Ungava District (now Quebec), the Hudson's Bay Company started to tap the Eastern Arctic fur resources. White fox is the only economic fur-bearer living in the Arctic tundra area, but catches were good and a market was available, enabling the Company to increase the number of its posts and encourage more of the Eskimo inhabitants to become trappers. Revillon Frères, a French-Canadian trading company, established posts in the Eastern Arctic during the 1920's, but was bought out by the Hudson's Bay Company in 1936.

Posts were opened along the coasts of Hudson Strait and northward in Baffin Island:—Lake Harbour (1911), Cape Dorset (1913), Stupart's Bay (1914), Frobisher Bay (1914), Pangnirtung (1921), Pond Inlet (1921), River Clyde (1923), Arctic Bay (1926 and again in 1936), and Fort Ross (1937). The ice-breaker *Nascopie* was built by the Hudson's Bay Company in 1912 to bring annual supplies to these isolated posts, and the sturdy ship has continued to service this ever-increasing trade up to the present.

Throughout the years when settlement was spreading across Canada the Northwest Territories remained a vast fur preserve which annually produced a large fur catch for the scattered native population. These pelts were turned in at the trading-stores for more and more of white-man's goods until the native life became almost completely centred around trapping. As population spread northward, exploitation of the fur resources of this frontier area increased. Independent fur-traders entered the field, but few were able to compete





The preserves and sanctuaries of the Northwest Territories are enclosed in heavy black lines. They are maintained primarily for native hunting and trapping.

successfully with the efficient organization and widespread service of the Hudson's Bay Company. Competition for furs meant that overtrapping was encouraged and little was done to protect the fur-bearers. This situation was, unfortunately, encouraged by the false assumption that such vast areas with a sparse population could not be depleted.

The number of white trappers increased rapidly during and after the years of the Klondike gold rush, when some of the gold-seekers remained in the Territory. A further influx came during World War I when fur prices rose steeply, and another increase, after 1920, followed the collapse of the oil "boom" at Norman Wells. The intensive trapping of the two decades (1900-20) was one of the chief factors in reducing the numbers of certain Mackenzie District fur-bearers.

When the present Northwest Territories Administration was organized in 1921, conservation regulations were immediately instituted to protect the declining fur-bearing animal population. The Northwest Territories Game Regulations*, which have been evolved over the years, are concerned with two vital factors: (1) the welfare of the native population, and (2) the economical harvesting of the fur crop. The former is reflected in the regulation which limits the number of white trappers to resident British subjects who held licences on May 3, 1938, and have continued to live in the Territories. Newcomers are not allowed to trap in the Territories. Such restrictions recognize that the welfare of the Indians and Eskimo now depends on trapping and provide protection from excessive white competition. The natives have been further assisted by the setting aside of several large preserves in which only native-born Indians, Eskimo, or half-breeds living the lives of natives are permitted to hunt or trap. No trading-post can be opened without permission from the administration and approval of its location. This centre then serves the natives for either food or relief in times of stress.

*Administration of the Act comes under the Minister of Mines and Resources, who is advised by the Northwest Territories Council. Direct Supervision is the responsibility of the Bureau of Northwest Territories and Yukon Affairs, while enforcement is carried out by the R.C.M.P., who are *ex officio* Game Officers. A booklet containing game regulations may be obtained from the Bureau of Northwest Territories and Yukon Affairs, Dept. of Mines and Resources, Ottawa.

The second aim of the regulations, the economical harvesting of the fur crop, is more difficult to attain, [5] and depends largely upon having an accurate picture of the number of animals being trapped regionally within the Territories. Measures have been instituted towards this end: (1) declaring open and close seasons upon the trapping of most animals; (2) fixing a maximum bag for certain fur-bearers; (3) creating preserves and sanctuaries in which no one is permitted to hunt or trap, (e.g., Thelon Game Sanctuary), and others in which only those who hunted or trapped before the creation of the preserve are granted permits (e.g., Wood Buffalo Park, Mackenzie Mountains Preserve).[6]

The Administration keeps abreast of fur and game conditions by co-ordinating information supplied by various organizations in the area.* Each trader reports the total number of furs of all kinds which are turned in at his store, and a record is maintained of the Fur Export Tax paid on each pelt. Similarly, the R.C.M.P. fill in "Native Game and Fur Returns" from information supplied by individual natives. The police officers further assist by submitting periodic reports on general game and fur conditions within their areas.[7] Every two years a wildlife conference is held in Ottawa with representatives of the provinces attending to exchange facts and opinions concerning wildlife management.[8] Information of this nature has been assembled here to present not only a picture of fur production in the Northwest Territories, but also a more detailed study of fur catches within smaller regions of this extensive area.

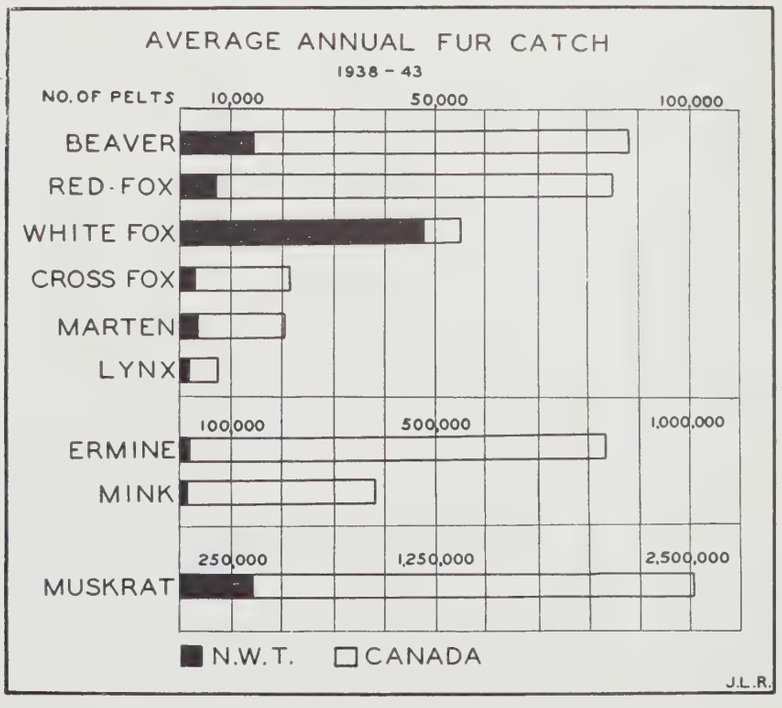
Present Fur Trade

By virtue of its geographic and climatic environment, Canada is destined to continue playing an important role in the fur trade of the world, provided that adequate supervision is exercised. Although the relative value of the fur trade is decreasing as Canada becomes more industrialized, the absolute value of fur production has remained generally constant during the past twenty years, averaging about $15,000,000. annually. As more and more of our country became settled, the trend was to bring the furs closer to the market by fur-farming. Fur farms, producing chiefly silver foxes and mink, have contributed about 30 per cent of the value of Canadian production over the past ten years.

The Northwest Territories contain some of the best fur environment of Canada, producing pelts of prime value. Since their area comprises more than one-third of the Dominion, and much of this great region is economically suitable only for the production of fur, the importance of Northwest Territories fur to the total trade of Canada is considerable. In total value, the fur catch of the Territories has continually constituted about one-tenth of the value of the Canadian catch during the past two decades. In total number of pelts, the Dominion-wide harvests have increased in the past ten years from about 4,000,000 annually to over 7,000,000, while those of the Territories have increased from about 200,000 to 500,000 pelts. The accompanying chart illustrates the average annual catch of various N.W.T. fur-bearers during five years (1938-1943) as compared with the same averages for all of Canada. The relative importance of white fox, beaver, and muskrat is clearly evident.

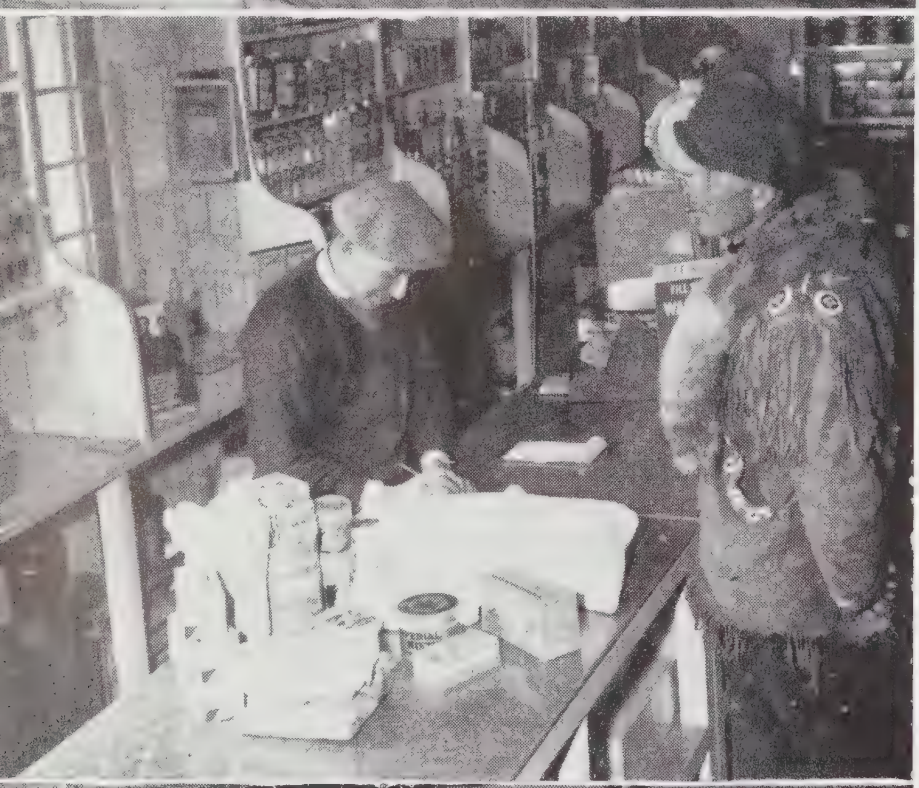
Until 1920 the fur trade was virtually the only industry of the Territories. In that year oil was struck below Fort Norman and the attention of prospectors was directed northward. It was not until the discoveries of radium in 1930 and gold at Yellowknife in 1934 that mining began to displace the fur trade as the region's chief industry. Because of the geographic character of the country, however, and the dependence of the native population upon the fur trade, the latter industry will remain fundamental in the economy of this area.

White trappers are not numerous in the Northwest Territories. Although the number

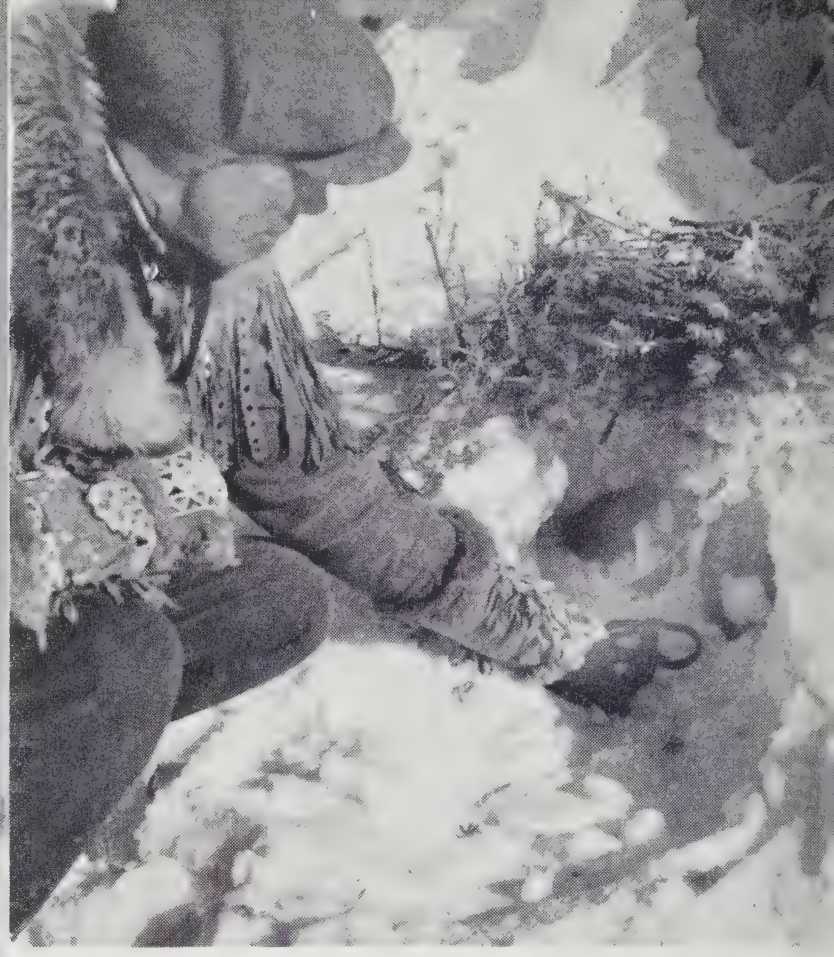


*This information has also been assembled by the Bureau of Animal Population, Oxford University, and parts of it were published in a series of annual articles in the *Journal of Animal Ecology*, Cambridge, England. "Canadian Arctic Wildlife Enquiry, 1935 to 1942", by D. Chitty.









Above:—An Indian trapper sets a mink trap in the snow.

of trapping licences issued each year remains between 500 and 550, the actual number of active trappers is much smaller. Most of the present-day trappers are old-time residents of the Territories.[9] Nearly all of them live in the Mackenzie Valley, chiefly around Fort Smith, Simpson and Aklavik. Only a few trap in southern Keewatin District and none in the Arctic Islands (Franklin District). The following table shows that about 20 per cent of the furs traded are caught by white trappers, and this percentage has remained fairly constant over the past decade.

AVERAGE PERCENTAGE OF EACH FUR-BEARER TAKEN BY WHITE TRAPPERS

	1932-35	1940-43
Red Fox	39	42
Lynx	29	23
Mink	22	23
Muskrat	15	20
Ermine	25	20
Beaver	12	19
Marten	15	10

Trapping is the chief source of income of the Mackenzie District Indians, but they still depend upon wild game for a large part

Top to bottom:—

The Indian proudly displays some of the best samples of his winter's catch.

Furs are traded at the nearest store for staple food.

The trading company hangs the furs in a warehouse, where they will later be graded.

—Photos courtesy *The Beaver*

of their food.[10] Summer fishing usually provides enough fish to keep families and dogs alive, and larger autumn catches are dried or salted to be used during the early winter. Fresh meat is obtained during the winter from moose or the wandering herds of caribou. Trapping begins in November when there is enough snow on the ground for travelling. A group of families usually camps together, living either in tents banked with boughs or in log cabins. The men visit their trap-lines periodically to bring in fur, while the women and children remain around the central camp. Occasional trips are made to the nearest trading-store to exchange winter furs for food and supplies, and nearly all natives come to the settlements for the religious holidays of Christmas and Easter. Most families own log cabins in the white settlements and spend one or two months there during the summer.

The present fur trade of the Northwest Territories is still predominantly in the hands of the Hudson's Bay Company, which has 41 trading-stores in the Territories and an additional nine in Arctic Quebec.* Of the remaining 103 traders, most are individuals, and no other organization has more than three stores. In total numbers of pelts, the muskrat is the leading fur animal of the region, followed by white fox, beaver, ermine, red and cross fox, mink, marten and lynx. Since most of Keewatin and all of Franklin District are north of the tree-line, nearly all the fur-bearers, excepting white fox, are caught in Mackenzie District. It is to the latter district that most of the following material refers.

The accompanying graphs (on which only the leading five regions and one of the lowest are shown) illustrate the numbers of various fur-bearers caught within certain districts during the period 1932 to 1943. They show which areas are the chief producers of certain types of fur, and also mark the cyclic variations in numbers caught. Biologists believe that nearly all fur-bearers fluctuate in numbers over a period of years; e.g., four-year cycle for white fox, and ten-year cycle for lynx.[11] The graphs show regionally the actual numerical variations produced by these biological phenomena, but even their significance must be interpreted with caution.

The charts illustrate the numbers of furs traded at the stores, and, although these figures should approximate to a percentage of the number of animals in the wild, such factors as good or bad hunting seasons, availability of food, ambition of the natives, climatic cycles, forest fires, current fur prices, conservation measures, new trading-posts, and other human disturbances must be considered before arrival at definite scientific conclusions. Despite these difficulties, trends and fluctuations can be seen, and the information is important in planning future conservation measures.

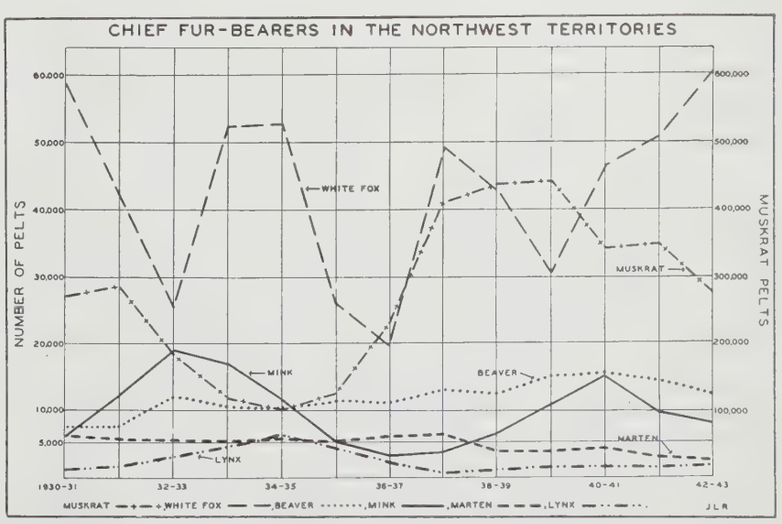
Muskrat: About 300,000 muskrat, representing 1/7 of the Canadian muskrat catch, come from the Northwest Territories, and at present 75 per cent of this total is obtained in the Mackenzie River delta. Here nature has created an exceptional habitat for these small fur-bearers. The Mackenzie River breaks up into a great number of rivers, streams and cut-off channels, and among them lie innumerable lakes of all sizes. Muskrat food is plentiful in the delta and, despite an annual harvest which now exceeds a quarter-million pelts, no decrease in numbers is evident. The delta has consistently been the best muskrat area in the Territories, its percentage of the total N.W.T. catch having steadily increased from 50 per cent in 1933 to 75 per cent in 1943.[12]

Muskrat are caught by being trapped, either in their houses in the ice or in burrows along the stream banks, and by being shot in the water after the ice breaks up. Equipped with a light "ratting" canoe and a .22 rifle, a native can move rapidly from one stream or lake to another and shoot from 100 to 200 "rats" in a night.

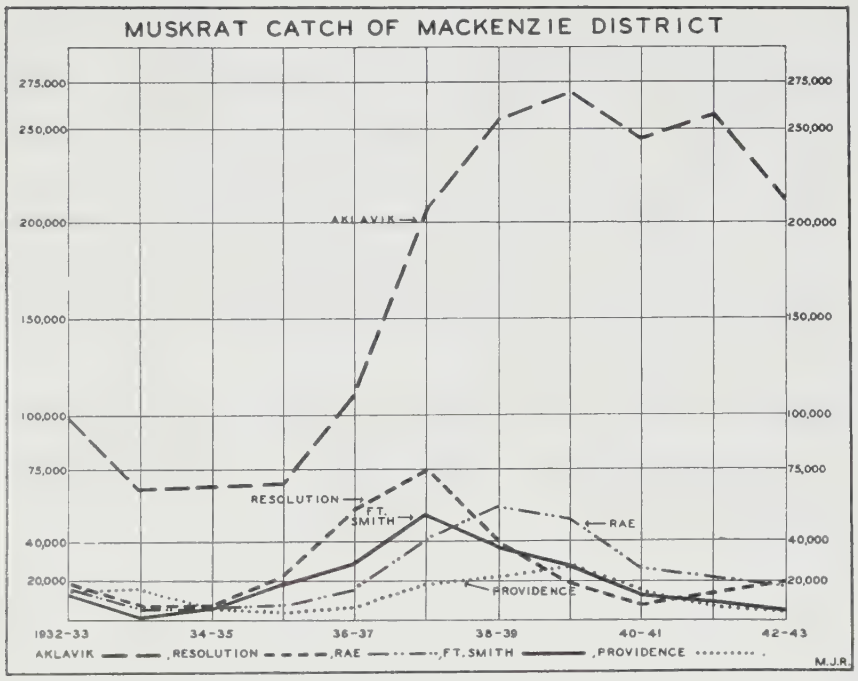
Smaller numbers of muskrat are traded at nearly all the Mackenzie Valley posts, since lowland, lakes and swamps are typical of the district. The most important of the lesser areas are Slave River delta (15,000 to 75,000 annually) and the lake country northwest of Fort Rae.

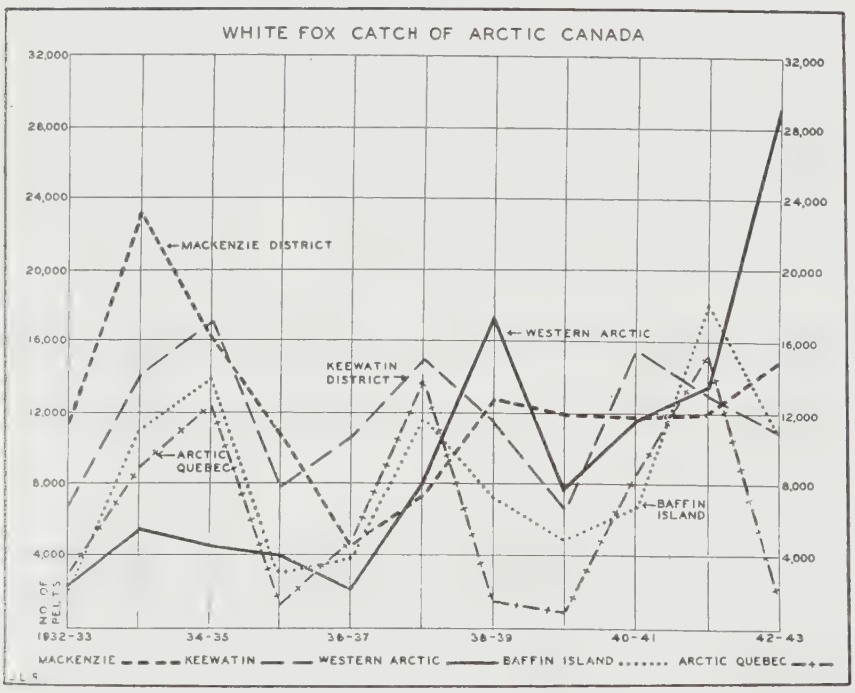
White Fox: Nearly all (an average of 87 per cent) of the Canadian white (Arctic) fox catch comes from the Northwest Territories, the remainder being caught in Arctic Quebec. Ranching attempts in southern districts, as well as in the Arctic, have not been successful. The white fox is one of the few economic resources of the Canadian Arctic and the only product which the Eskimo inhabitants can trade for white man's food, utensils, and equipment. Beacuse there is a definite short-period cyclic variation in numbers of white foxes, a factor of real instability exists in Eskimo economy.[13]

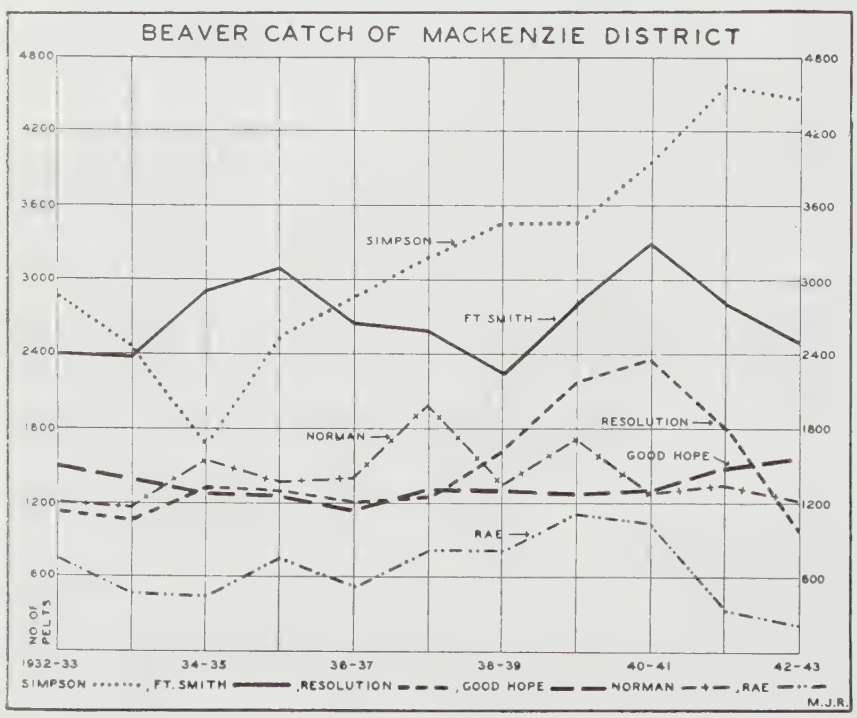
The variation is one of abundance every four years, with a particularly low year occurring between the peaks.[14] For example, the take in the Lake Harbour



*The Company has over 200 trading-posts in Canada







area, Baffin Island, dropped from a peak of over 4,000 pelts in 1941-42 to less than 200 in 1943-44. The accompanying graph shows that the four-year cycle in white fox numbers is fairly definite in the Eastern Arctic regions, but is less regular in the Western Arctic and Mackenzie District.

In Mackenzie District the white fox catch comes chiefly from two areas, both north of the tree-line. White trappers go out into the Barren Grounds east and north of Reliance, at the eastern end of Great Slave Lake, and spend the winter trapping in the area, returning to Fort Smith or northern Alberta settlements in the spring. The white fox catch at Aklavik comes largely from Banks Island, and the steady increase since 1937 is chiefly due to the rich catches resulting from a change to inland trapping by the Eskimo on the island.

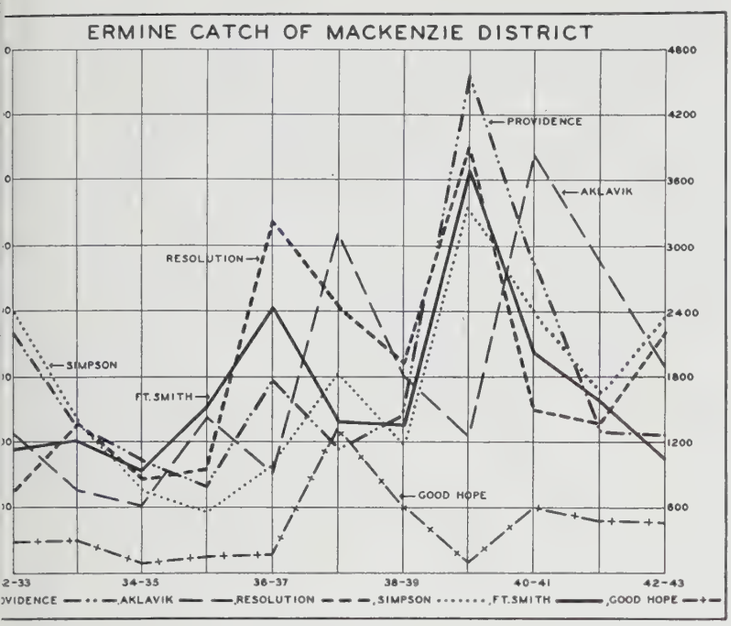
The Eastern Arctic region, which includes Baffin Island, Keewatin District and Arctic Quebec, is the leading producer of white fox pelts. Among the smaller comparative areas which are shown on the graph, Keewatin District has been a consistently good producer. The Western Arctic region, which includes the western Arctic Islands and the north coast of Mackenzie District, has returned exceptionally large catches in some years, and has increased in importance since 1937.

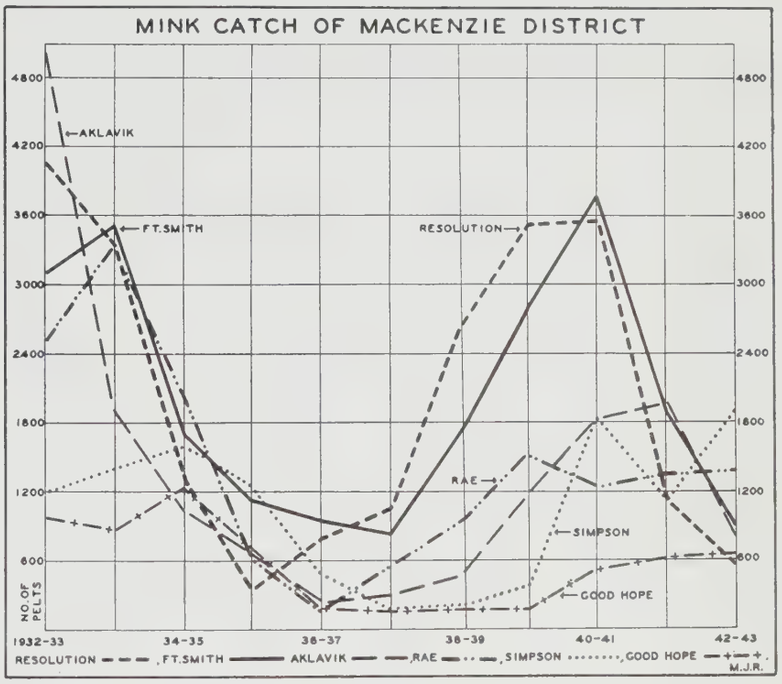
Beaver: The Northwest Territories produced about 15 per cent of the annual Canadian beaver catch during the years 1938-43, and this proportion has increased in recent years as a result of close seasons in other provinces. Despite the fact that numbers caught in the Territories have remained fairly constant (about 12,000 annually during the decade preceding 1943), it was believed that the area was being overtrapped, and conservation measures have become necessary to maintain the supply. A close season was declared in 1928 for three years in Mackenzie District, and when it was reopened in 1932 a quota of fifteen beaver per hunter was decided upon. By 1940 beaver were almost exterminated in the Mackenzie River delta, and the area was set aside as a special sanctuary in which they could not be trapped.

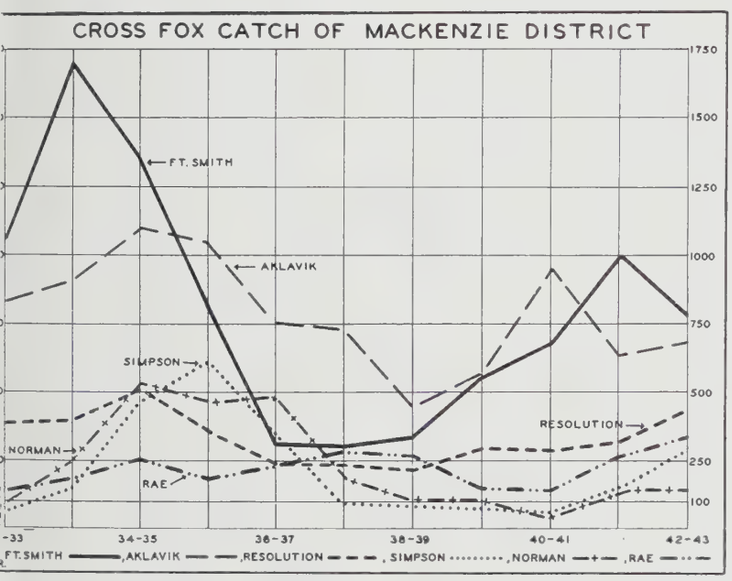
Current high prices of fur have resulted in further inroads into the beaver population of the southern part of Mackenzie District, necessitating a close season in the area south of Liard River and east of a line joining the Liard River and Great Bear Lake. North of this area the season has been shortened to two months (March and April), the quota reduced to ten, and shooting of beaver prohibited.

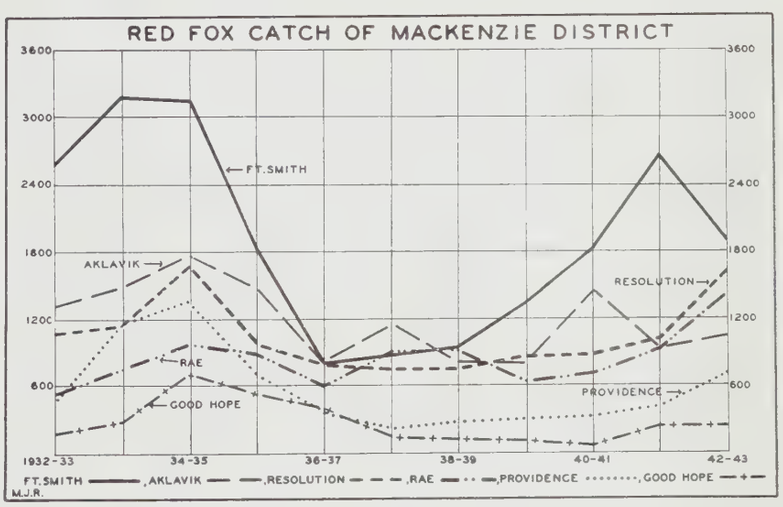
There appears to be little cyclic variation in the Mackenzie District beaver catch, as indicated by the accompanying graph; slight fluctuations in various regions depend largely on current regulations and prices. In general, the number trapped and shot increased from 1939 to 1941, but since then totals have fallen off, especially at the southern posts. Catches at Fort Simpson have remained consistently high and increasing, while those from the lower Mackenzie River posts of Norman, Good Hope and Arctic Red River have remained fairly constant (about 1400 annually).

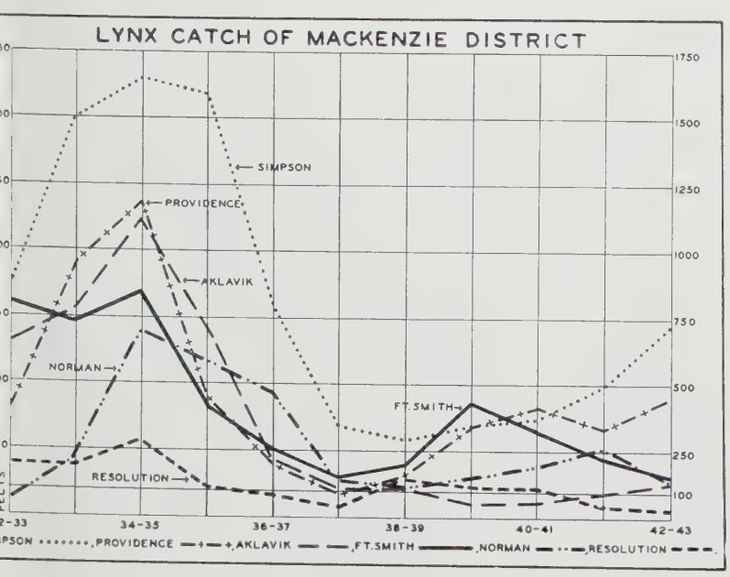
Beaver is one of the fur-bearers easily exterminated, and the record in the Territories, as well as in the rest of Canada, shows a tendency towards depletion. At the same time, beaver is one of the fur-bearers easiest to preserve under careful management. Successful experiments with beaver sanctuaries, such as those run by the Hudson's Bay Company on Charlton and Akimiski Islands in James Bay, show that a harvest can be obtained without depleting the supply.(15) These projects point the way for similar steps in other parts of the Territories.

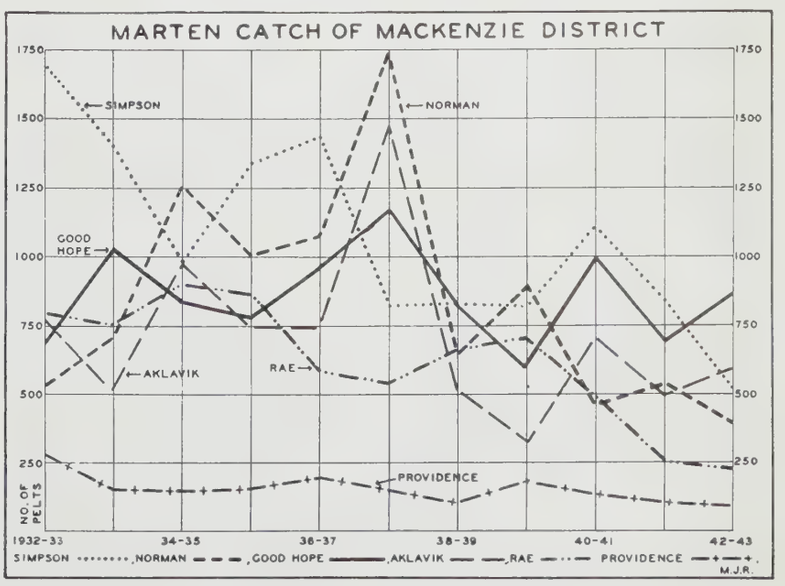

ERMINE CATCH OF MACKENZIE DISTRICT
PROVIDENCE
AKLAVIK
RESOLUTION
SIMPSON
FT.SMITH
GOOD HOPE
4800
4200
3600
3000
2400
1800
1200
600
34-35
36-37
38-39
40-41
42-43
AKLAVIK, RESOLUTION, SIMPSON, FT.SMITH, GOOD HOPE


MINK CATCH OF MACKENZIE DISTRICT
AKLAVIK
FT.SMITH
RESOLUTION
RAE
SIMPSON
GOOD HOPE
NO. OF PELTS
4800
4200
3600
3000
2400
1800
1200
600
1932-33
34-35
36-37
38-39
40-41
42-43
RESOLUTION, FT.SMITH, AKLAVIK, RAE, SIMPSON, GOOD HOPE
M.J.R.


CROSS FOX CATCH OF MACKENZIE DISTRICT
FT. SMITH
AKLAVIK
SIMPSON
RESOLUTION
NORMAN
RAE
1750
1500
1250
1000
750
500
250
100
34-35
36-37
38-39
40-41
42-43
FT.SMITH, AKLAVIK, RESOLUTION, SIMPSON, NORMAN, RAE

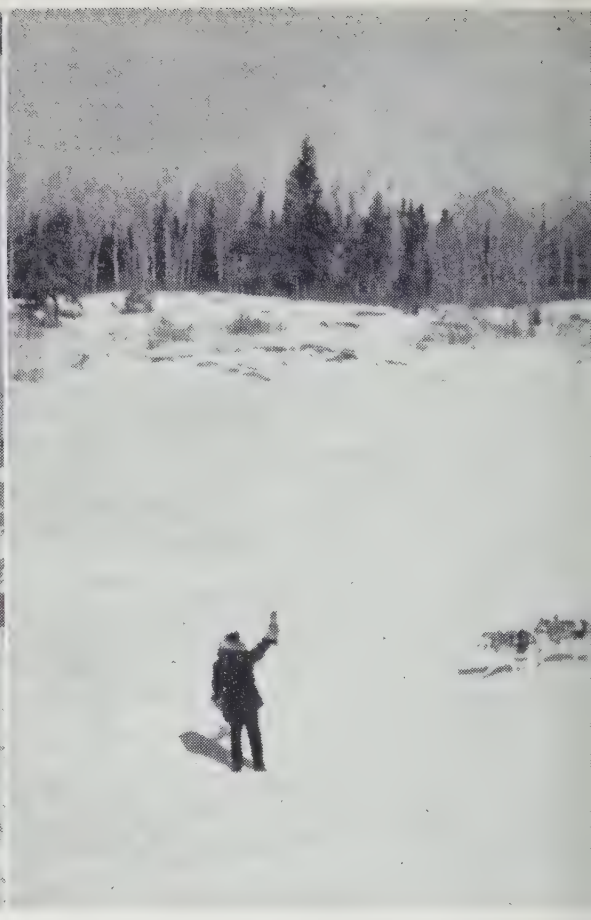

RED FOX CATCH OF MACKENZIE DISTRICT
FT.SMITH
AKLAVIK
RESOLUTION
RAE
GOOD HOPE
PROVIDENCE
3600
3000
2400
1800
1200
600
1932-33
34-35
36-37
38-39
40-41
42-43
FT.SMITH, AKLAVIK, RESOLUTION, RAE, PROVIDENCE, GOOD HOPE
M.J.R.


LYNX CATCH OF MACKENZIE DISTRICT
SIMPSON
PROVIDENCE
AKLAVIK
NORMAN
FT.SMITH
RESOLUTION
1750
1500
1250
1000
750
500
250
100
34-35
36-37
38-39
40-41
42-43
PROVIDENCE, AKLAVIK, FT.SMITH, NORMAN, RESOLUTION


MARTEN CATCH OF MACKENZIE DISTRICT
SIMPSON
NORMAN
GOOD HOPE
AKLAVIK
RAE
PROVIDENCE
NO. OF PELTS
1750
1500
1250
1000
750
500
250
1932-33
34-35
36-37
38-39
40-41
42-43
SIMPSON, NORMAN, GOOD HOPE, AKLAVIK, RAE, PROVIDENCE
M.J.R.



White trappers arrive at a trading-post on James Bay. Note the caribou parka worn by one of the men.



Trappers in the woodland country

Ermine: Although the ermine (weasel) catch of the Territories ranks fourth in total numbers, its relative value is much less. The area produces only 1.5 per cent of the total Canadian annual catch. Ermine is known as an "incidental" fur at the trading-posts; i.e., very little attempt is made to trap ermine, and those turned in are usually caught in traps set for other animals. Much of the ermine catch results from the trapping activities of boys who are learning the fundamentals of their future occupation.

Regional totals fluctuate with slight peaks occurring every two or three years. A peak was reached in 1939-40, and totals have declined rapidly since then. Largest returns of ermine are recorded at the southern settlements of Providence, Resolution and Smith, with the Aklavik area increasing recently. Lower totals at Norman and Good Hope are due chiefly to the smaller number of Indians trapping in the area.

Coloured Foxes: Red foxes are the most numerous of the coloured foxes in the Territories, and their pelts are classed as one of the cheaper types of fur. Since there are no fox farms in the Territories, the catch amounts to only 7 per cent of the Canadian total. One of the important recent trends has been the extension northward of the red fox range. They are now found in small numbers beyond the tree-line and are causing an economic problem by destroying the more valuable white foxes in the traps.

There appears to be a ten-year cycle in the population of red foxes. A peak was noted in 1934-35 at nearly all settlements in the District, and another was reached in 1944. The bottom of the cycle occurred during the years 1937-39, which were also low years for some of the other fur-bearers of the region. The Fort Smith area has always produced the largest number of red foxes, followed by the Aklavik, Resolution and Rae regions.

Cross foxes are found in smaller numbers in the same areas, and follow the same general cycle as red foxes. One of the chief differences is the proportionately



Aerial views of Mackenzie River delta—some of the best muskrat habitat in Canada



basket sled and dogs in a single line.



In the Eastern Arctic trappers have adopted the Eskimo komatik sled and fan-hitch for dogs.

Photos courtesy *The Beaver*

larger number of cross foxes (as compared with the number of reds) that are trapped in the Aklavik-Arctic Red River-McPherson area. The Fort Smith and Resolution areas produce the largest numbers of cross fox pelts as well as red.

The cyclic fluctuations of the fox population have long been studied by the biologists, (16) but many phases are still unexplained. Whether the cycles are due to a straight predator-prey relationship, to periodic disease epidemics, or to combinations of these and other factors, is still to be fully determined. It is particularly noticeable that the Aklavik and Rae areas do not follow the general fox cycles of the other sections.

Mink: The mink is an old stand-by in the fur trade of Mackenzie District. As in the case of many other fur-bearers, it appears to have a seven to nine year cycle of abundance. Mink are always found near water; thus the Mackenzie River delta area and other lake-dotted sections form excellent habitats. Fine mink pelts come from Mackenzie District, but, since much of the Canadian mink production comes from fur farms nearer the markets, the Territories' catch amounts to only about 4 per cent of the Canadian total.

Since the trend in fur production is towards fur-ranching and controlled wild catches, it may be significant that three of the five fur farms in the Territories are to-day successfully raising mink. Two of these are located in the Mackenzie delta area south of Aklavik, and the third is on an island near Yellowknife. The mink are fed on imported meal, but their diet is supplemented by fish, which are found throughout the Territories in large numbers.

Within the last twenty years there have been three mink peaks in Mackenzie District. The first was recorded in 1923-24 and totals were higher (21,000) than in the next peak of 1932-33 (18,000). The second peak was not reached until a year later at some of the settlements, and was not evident until 1934-35 at Simpson, Norman and Good Hope. The third peak



Photos by J. L. Robinson

Right:—Cross fox

Below:—Beaver

National Parks photos





of 1940-41 also varied regionally within the District over a period of three years. As is the case with many of the fur species which are being actively trapped, it is noticeable that succeeding peaks tend to be lower than previous ones. Careful attention will be given to the expected mink peak of 1948 to determine if the total mink population of the District is actually declining, or if the smaller catches are due to the low-water period of recent years.

In good years the Slave River delta area, tributary to the posts at Resolution and Rocher River, has had the largest mink catch, but, strangely, has had one of the lowest in poor years. Mink numbers have been more consistent around Fort Smith, but the Aklavik and Rae areas failed to reach the peaks in 1940-42 which were recorded in 1932-33.

Marten: Mackenzie District was once the best marten country in Canada. In the period 1851-56 the average annual marten total exceeded 30,000 pelts, and some sections produced numbers greater than the present take of the whole Dominion. (17) Excessive trapping soon decimated this valuable fur-bearer, and by 1930 the average annual catch of Mackenzie District was only about 5,000 pelts. In 1936 the marten season was shortened one month, and in 1940 a quota system of two animals south and twenty north of the Mackenzie-Liard Rivers limited each trapper's catch. As there was no apparent improvement in the following years, a close season was declared in 1943 which is to remain in effect until marten recover their status. Since the District was producing about 18 per cent of the Canadian catch, closing the season reduced the income of Indians and whites, but fortunately this has been balanced by increased prices for other furs.

Marten live in the high forested valleys of the South Nahanni and Peel Rivers in the Mackenzie Mountains and also in the lowland swamps north of Great Bear Lake. Since the closing of the season in Mackenzie District, Indians from Arctic Red River and Fort McPherson have been able to go into the Peel Valley of Yukon Territory and bring out valuable catches of marten. In recent years the marten population has been too low to show any cyclic fluctuation, but the graph does illustrate the rapid decline of marten at Simpson, Norman and Rae, and the relative increase at Good Hope and Arctic Red River. The Resolution-Providence area, along the south shore of Great Slave Lake, has had few marten in the past decade.

Lynx: The Canadian lynx catch is comparatively small (about 7,000 pelts annually), and about 22 per cent came from the Territories during 1938-43. It has been fairly well established that lynx have a ten-year cycle of abundance, which is correlated with the cyclic abundance of rabbits. (18) The Mackenzie lynx peak occurred in 1934-35 and, although complete totals have not yet been tabulated, it was expected that the winter of 1944-45 would also see an increased catch.

The Simpson-Providence area is the only section where lynx are caught in comparatively large numbers. The Arctic Red River-McPherson area had a good catch in 1934-35, but has done poorly since. During the period of scarcity catches were low at all settlements except Simpson. Rae and Resolution have continually been poor areas for lynx.

Other Fur-Bearers: In addition to the chief fur-bearers described above, there are others that are caught in smaller numbers in the Territories. Coloured foxes include from 200 to 400 silver foxes annually, trapped chiefly in the southern part of Mackenzie District, and about ten to twenty black foxes. Blue



Left:—Marten
National Parks photo

Below:—Muskrat
Photo courtesy *The Beaver*



foxes (a colour phase of the white fox) are found in the same Arctic areas as white foxes at a ratio of about one per cent. About 300 otter are trapped annually, coming chiefly from Fort Smith and Rae. The fisher is one of the most valuable of Canadian fur-bearers, and, although a few hundred are trapped annually in northern British Columbia, 36 has been the highest number caught in any one year in the Territories since 1932. Skunks are found occasionally in traps, and from 50 to 100 are turned in each year to the posts. From 500 to 1,000 wolves are shot or trapped annually, and, although their fur value is not high, they are killed whenever possible. Wolves and, in the Barren Grounds, wolverines prove the Nemesis of trappers, for each year they destroy valuable fur in the traps.

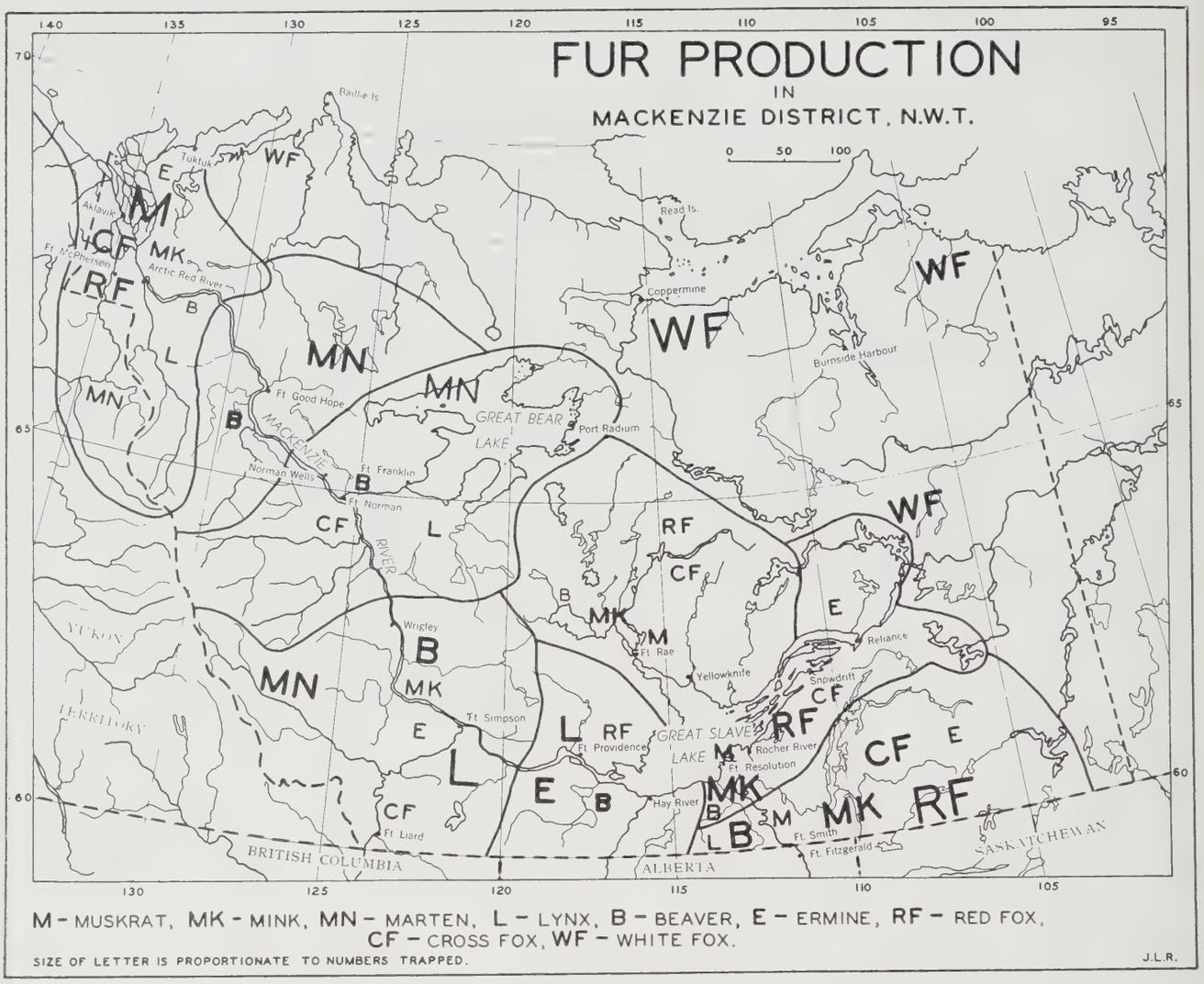
Conclusion

In breaking down the Territories' fur catch into regions, one is able to see where the various centres of animal population are located. Some areas are important because they produce the largest percentage of certain furs, while others are important for the general high numbers of a variety of furs. The accompanying map illustrates the regions tributary to the posts which were used on the graphs, and the chief fur-bearers of each region. In order to obtain some idea of the densities of mammal populations, one should correlate the number of pelts caught in each area with the number of trappers. (See map of Indian population.)

The following table rates the importance of each region in the production of pelts of eight chief fur-bearers of Mackenzie District. It readily shows the significance of Simpson as a fine-fur area, since this section, which includes the posts of Liard and Wrig-

LEADING FUR AREAS OF MACKENZIE DISTRICT

Place	Beaver	Marten	Lynx	Mink	Muskrat	Red Fox	Cross Fox	Ermine	Indian Population
Fort Smith	2	6	3	2	4	1	1	5	290
Resolution	3	7	8	1	3	3	3	2	584
Providence	6	8	2	6	5	5	7	1	523
Rae	8	5	6	4	2	4	4	6	918
Simpson	1	1	1	5	7	6	6	3	657
Norman	4	3	4	7	8	7	5	7	374
Good Hope	5	2	7	8	6	8	8	8	337
Aklavik	7	4	5	3	1	2	2	4	639



ley, ranks first in the production of beaver, marten and lynx, the more valuable furs. This importance is mirrored by the fact that there are fifteen to twenty traders in the Simpson area and twelve active white trappers. In total numbers of all furs, Fort Smith ranks highest, recording fairly large numbers of all species excepting marten. This area, which includes the northern part of Wood Buffalo Park, produces the greatest number of coloured foxes and rates second in beaver and mink. The Resolution area, which includes the trading-posts at Rocher River and Snowdrift, is also one of the leading general fur areas, ranking among the first three producers for all furs excepting marten and lynx.

In total annual value of fur production, the Aklavik-Fort McPherson-Arctic Red River area is by far the most valuable section of the Northwest Territories. During the period 1938-43 the average annual catch had a value of over $500,000. Two chief fur-bearers, muskrat and white fox, constituted 85 per cent of this value. The remaining centres, listed in the following table, have annual catches valued at from $100,000. to $200,000., and usually the value of one particular fur-bearer is about 40 per cent of the total. In the Resolution area, for example, the white fox catch from east of Reliance has been the most valuable. At Fort Smith beaver constituted 36 per cent of the average annual value, while at Simpson 55 per cent of the total value consisted of beaver pelts. Similarly, at Providence, Norman and Good Hope beaver comprised 36 per cent of the annual fur value, but muskrat was the most valuable fur-bearer at Rae.

AVERAGE ANNUAL VALUE OF FUR PRODUCTION

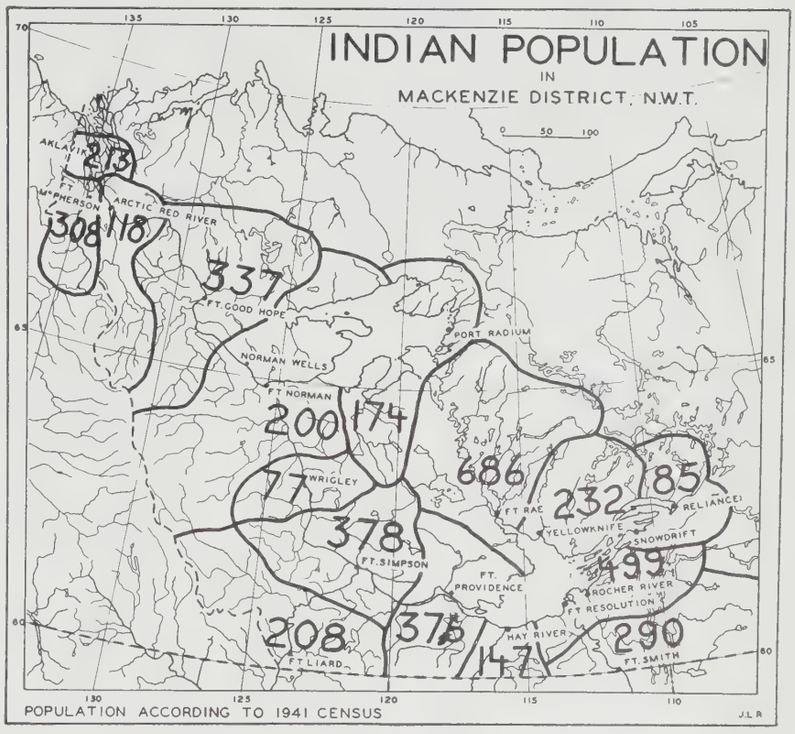
1938-43

Aklavik	$505,000.
Resolution	$198,000.
Fort Smith	$190,000.
Simpson	$175,000.
Rae	$140,000.
Good Hope	$ 90,000.
Norman	$ 90,000.
Providence	$ 87,000.

The general picture of fur production in the Northwest Territories shows that there are periods of fluctuation in the numbers of various fur-bearers.[19] The years 1933-35 were generally good fur years, while the period 1936-39 resulted in poor catches. From 1940 to 1944 catches were again quite high, but whether this was due to the very high prices paid for furs during the war years, or simply to a period of fur abundance, can be determined only over a longer period.

The successive peaks for most species have gradually become lower and lower in the Territories. It was apparent that even this sparsely-settled fur area could not withstand intensive trapping, and regulations were instituted to curtail overtrapping.[20] Fur catches are now more controlled, but the depletion of certain stocks means that conservation and restocking steps are necessary to build up the area to its former position as a fur-producer. Before such measures can be instituted, further research work and study are necessary to determine more closely the actual status and numbers of fur-bearers in the Territories.

In order to maintain fur production in the Territories, the Administration is introducing an improved system of forest fire protection and preparing a programme of conservation education for the natives. The establishment of fur farms is being encouraged as a means of stabilizing production. Plans under consideration for future wildlife management include the improving of certain areas, (by methods similar to those employed in 1938 in Wood Buffalo Park with the construction of dams and earthfills to maintain water levels), special supervision of productive areas like the Mackenzie Delta, and the introduction of registered trap-lines to prevent overtrapping.



The Northwest Territories provide a natural environment excellently suited for fur production—a resource which utilizes large areas of apparently useless country. In the current inventories of resources of our vast Canadian Northwest, the fur-bearing animals must have proper attention in order to maintain their position in the total Canadian economy. The fur trade of the Territories has seen many changes, but it is not a spent force nor in danger of extinction if wise management prevails. Because of its importance to the natives and the permanent white population, one can feel confident that fur will remain one of the most valuable exports of the Territories.



A small mink farm operated by a white trapper near Aklavik.



One of the main cabins of a white trapper's trap-line near Fort Simpson

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A group of permanent Indian cabins at Arctic Red River, N. W. T.

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Exploration and Settlement of Mackenzie District, N.W.T.*

by M. J. and J. L. ROBINSON**

MANY WHO have read about the recent production of oil at Norman Wells, the extraction of radium and uranium at Port Radium, and the gold-mining activity at Yellowknife, have realized that the settlements of Mackenzie District, Northwest Territories, are now playing a significant part in world affairs. There is a story behind the rise of these modern settlements which is a little-known chapter in Canadian history.

Just as mineral discoveries are now attracting numerous people to Mackenzie District, so it was that the search for a mineral—copper—brought the first white explorer into the region 176 years ago. During the intervening years history has moved slowly, but has contained exciting tales of exploration and records of the first lonely post settlements.

Early Exploration, 1770-1850

Samuel Hearne, employed by the Hudson's Bay Company, left Fort Prince of Wales (now Churchill, Manitoba) in December, 1770, with a band of Indians from the interior, hoping to discover the source of the copper which had often been brought to the post. The Company encouraged his overland expedition because it was hoped that his exploration might also throw some light on the supposed existence of a sea passage north of the Canadian mainland.(1) Hearne reached Coppermine River about 40 miles from its mouth and mapped the remaining distance to the sea. Although his computed latitude proved to be too far north, his travels were important geographically because he located the first section of the northern mainland of Canada. (See Hearne's

*Prepared at the Bureau of Northwest Territories and Yukon Affairs, Lands, Parks and Forests Branch, Dept. of Mines and Resources, Ottawa.

**Photos by J. Lewis Robinson except where otherwise credited.

At top:—The business section of Yellowknife, N.W.T.—built up on the side of a bare, rocky hill. Photo by F. Whyard

Cover photo:—The Roman Catholic Mission buildings at Fort Providence

route on the accompanying map of exploration.)

Hearne's return trip lasted almost a year, during which time he lived the same roving, hunting life as did his Indian companions. His sketch map of his travels provides us with our first record of the huge interior body of water now called Great Slave Lake. In the spring of 1772 Hearne and the Indians turned eastward and snow-shoed through 600 miles of woods, arriving back at Fort Prince of Wales at the end of June.

Hearne's overland trip supplied evidence of the magnitude of the mainland of Northern Canada. It was realized that, instead of a narrow strip of land barring the way to the riches of the Far East, a whole continent stretched west of Canada and the American colonies. Within a decade of Hearne's travels fur traders of the North West Company in Montreal were penetrating Mackenzie District from the south. Their aim was to trade directly with the Indians and cut off the Hudson's Bay Company's supply of furs at its source.(2)

In 1786 a trading-post was established temporarily by Cuthbert Grant on Great Slave Lake, a short distance east of the mouth of Slave River. It was the first white habitation within the present boundaries of the District but was withdrawn in 1787. In 1788 the North West Company built an important trading-post, called Fort Chipewyan, on the south shore of Lake Athabaska, about eight miles east of Athabaska River. It was from this post, which was to become the distributing centre for the entire northwestern fur trade, that Alexander Mackenzie left on June 3, 1789, on his historic canoe trip to the Arctic Coast.(3)

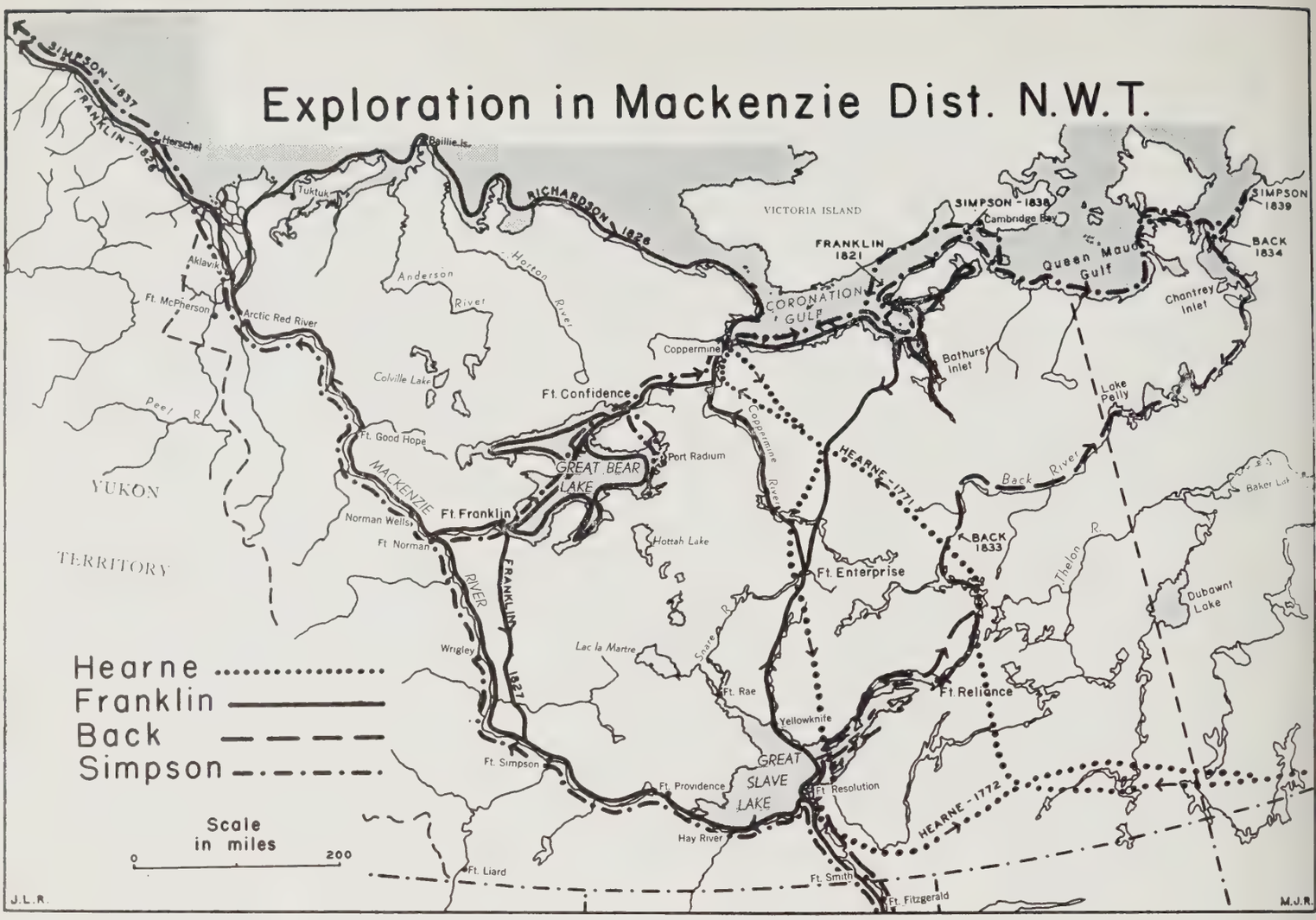
Mackenzie and his accompanying group of Indians and French-Canadians reached Great Slave Lake on June 9, but found it still ice-covered. The canoe party finally worked from island to island across the east side of the lake to Yellowknife Bay where they met a band of "Red-Knife" Indians. Had Mackenzie been seeking gold instead of sources of fur he might have looked more carefully at the rocks of this now-famous bay! From here, Le Roux, Mackenzie's assistant, travelled overland to Lac La Martre and returned to Yellowknife Bay in the autumn to build the trading-post of Fort Providence (not to be confused with the present Fort Providence).

In the meantime, Mackenzie, still impeded by ice-floes, crossed the North Arm of Great Slave Lake, and reached the outlet of the lake on June 29. His expedition, comprising four canoes, then paddled and floated down the broad river which now bears the discoverer's name, experiencing few difficulties during the journey. Mackenzie met several unknown tribes of Indians with whom he traded, and his accurate

Looking down Coppermine River at Bloody Falls, so named because of the massacre of a band of Eskimo by Samuel Hearne's Indians on July 16, 1771.

Bureau of N.W.T. & Y.A. photo





description of their clothes, utensils and habits forms our first record of the Valley's native inhabitants. On July 13 he had twisted through the maze of channels in the Mackenzie Delta to find his way blocked at Whale Island by ice-floes filling the "lake" to the north. Within the next few days he saw a school of white whales and noted a slight rise and fall of a tide. Even with this evidence, there is some doubt in Mackenzie's journal as to whether he had actually reached the sea.

Mackenzie's return journey, although uneventful, was more difficult because of the current. His journal gave some of the first indications of the mineral wealth which was to be found in the Valley. East of Arctic Red River he noted that: "Among the pieces of slate are pieces of Petroleum, which bears a resemblance to yellow wax but is more friable". Near the present site of Norman Wells he remarked on several small sulphur springs, and south of the mouth of Bear River described a bed of coal which was burning in the bank of the river.

Mackenzie's exploration demonstrated the navigability of 1,500 miles of new waterway, and located another point on the northern mainland. During the following three decades several posts were established along

Looking south over the settlement of Fort Fitzgerald, at the south end of Slave River portage road. H.B.C. buildings are on the left, hotel at right centre.



this great northern water route and a rich supply of furs was transported southward by a chain of rivers, lakes and portages to far-away Montreal.

Although Roderick McKenzie traded during the winter of 1790 at the outlet of Great Slave Lake, the first buildings on Mackenzie River were erected in 1796 on the north shore, a short distance west of Trout River. The post was abandoned, however, in 1799, when the trader, Livingstone, followed Mackenzie's route to the ocean and was murdered by Eskimo.[4]

Short-lived posts were opened on the west side of Great Bear Lake (1799), and opposite the mouth of the North Nahanni River (1800). More permanent posts were established during the following decade at Fort Simpson, Moose Island, Great Bear Lake, Fort Good Hope and Fort Norman.[5]

Mackenzie District thus had about a half-dozen widely scattered trading-posts when John Franklin of the British Navy entered the area in 1820 on the first of his great overland expeditions to the Arctic Coast. This was the period in history when the British Admiralty began its intensive programme of exploration through the Arctic Islands from Baffin Bay. Franklin's purpose was to explore and map the south shore of the Polar Sea, and, if possible, to help Parry's sea expedition which was sailing westward looking for a through-passage between the northern islands.[6]

Franklin and his party, which included such later-famous names as John Richardson and George Back, ascended Yellowknife River and built their winter quarters, called Fort Enterprise, on Snare River. In mid-June, 1821, the expedition left the fort and descended the rough and rapid Coppermine River. The Indian guides left them at Bloody Falls because of fear of the Eskimo, but the party continued with two brave Eskimo interpreters brought from Churchill for that purpose.

Franklin's expedition left the mouth of the Coppermine in mid-July in two birch-bark canoes which were continually stopped and almost crushed by the ice which filled Coronation Gulf. They charted the south coast of the Gulf as far as Kent Peninsula and explored to the head of Bathurst Inlet. On their return, because of scanty provisions and the approach of winter, Franklin chose to cross overland west of Bathurst Inlet to the head of the Coppermine.

The story of their straggling return over the uninhabited tundra is one of the epics of hardship and privation in Arctic literature.[7] For weeks they lived on lichens and were reduced to eating deer skins. Several of the party died. Back went on ahead and in early November, near Fort Providence, finally located some Indians who sent meat back to the starved expedition at Fort Enterprise. In mid-December the unfortunate explorers were taken to Fort Resolution, where they spent the rest of the winter of 1821-22.

Franklin's second expedition of 1825-27, profiting by the experiences of the first one,

Looking south over part of the Fort McPherson settlement, with Anglican Church on the right, Indian cabins on the left.





Panorama of Fort Resolution, looking north from the H.B.C. buildings. Note the

made arrangements with the Hudson's Bay Company to be kept in supplies.[8] P. W. Dease, a chief factor of the Company, was sent to Great Bear Lake in July, 1825, to open a post called Fort Franklin, near the site of the old North West Company post. In August Franklin and E. N. Kendall made a preliminary survey of the Mackenzie Delta. In the meantime, Back had joined Richardson at Great Bear Lake, and the two of them charted its shores.

In early September the entire expedition of 50 persons assembled at Fort Franklin and spent the winter there in comparative comfort. The following April, Richardson and Kendall completed the survey of Great Bear Lake. Following break-up of the ice on June 21, 1826, the party descended to the Mackenzie Delta and divided into two groups. Franklin and Back explored the Arctic Coast to the westward, after escaping from a large band of excited Eskimo who planned to kill them . They were continually hindered and delayed by fog and heavy ice which pushed southward. By keeping close to the shore in its two boats the expedition was able to chart 374 miles of coastline. Little did Franklin know that when he decided to turn back he was only 160 miles from an advance party of F. W. Beechey which had progressed eastward along the northwestern Alaskan Coast. The junction of the two expeditions would have completed the mapping of the northwest coast of the continent.

Richardson and Kendall travelled eastward and had somewhat similar difficulties, being troubled by shallow water, ice, gales, fog, and mosquitoes. They were able to complete their mapping, however, proceeding through Dolphin and Union Strait (named after their two boats), from where they reported new land to the northward (Victoria Island). The expedition walked up the west bank of the Coppermine, crossing to Great Bear Lake via Dease River.

The two groups were united at Fort Franklin in the autumn. Franklin stayed until February, 1827, and then completed the first overland winter trip for a white man southward from Great Bear Lake to Fort Simpson. (See map of exploration routes on page four.)

With the completion of the two Franklin expeditions the northern coast of the continent was charted from near Point Barrow, Alaska, eastward to Kent Peninsula, and the earlier explorations of Mackenzie and Hearne on the two main rivers were confirmed. Thus, within a period of 30 years, Canada's two largest fresh-water lakes were roughly mapped, the courses of the two chief rivers of Mackenzie District known, and a few scattered trading-posts housed permanent white residents. Except for Indian accounts, however, little was known about the character and resources of the country away from the main water routes.



ic Mission Church, hospital and school on the right, and the tennis court on the left.

When the news reached England that Sir John Ross' expedition to the Eastern Arctic was frozen in on Boothia Peninsula,[6] and might soon need help, George Back volunteered to lead an overland rescue party to this section of the Arctic Coast. He arrived at the eastern end of Great Slave Lake in August, 1833, and crossed overland to Aylmer Lake. Back discovered a short, low portage to the source of Great Fish (now Back) River, and followed it for a short distance to ascertain its direction. His expedition then returned to quarters at Fort Reliance, where they passed a difficult winter, often lacking food.[9]

In April, 1834, Back received news that Ross had arrived safely in England, but decided to continue the expedition and map part of the unexplored Arctic Coast. Back and his crew started in mid-June, using a novel method of pushing their boat on runners over the ice of the lakes and rivers to the source of Back River. After being delayed by ice during late July in Pelly and Franklin Lakes, they paddled to the mouth of the river to find the sea completely filled with ice-floes. Back spent several helpless days on Montreal Island in Chantrey Inlet, mapping only to the western entrance of the Inlet. In mid-August he started the return trip to Fort Reliance, which was abandoned later in March, 1835.

Back's expedition, covering a large section of the unknown interior, also located one more point on the map of the northern mainland. The final blanks were filled in by Thomas Simpson of the Hudson's Bay Company in 1837-39.[10]



rial view of Fort ith settlement, look- north at Slave River. te the street pattern d wide scattering of idences.





Group of pictures showing Mackenzie Valley Indians:—

Extreme left:—
Indian boy with a slice of bread and butter at Fort Good Hope

Left:—
Two Indian girls at Arctic Red River

Bottom left:—
A group of Indian boys at Arctic Red River

Below:—
An Indian family at Fort McPherson





Simpson and P. W. Dease travelled westward from the Mackenzie Delta in 1837, and, despite having trouble with ice, were able to make better progress than Franklin's previous expedition. Their boats, however, were finally stopped by heavy floes near Point Barrow, and Simpson decided to walk the short remaining distance. Fortunately, he was soon picked up by an Eskimo boat, and reached the most northerly point of Alaska on August 4. Simpson's mapping thus completed the outline of the northwestern mainland of the continent. The successful expedition returned to its winter quarters on eastern Great Bear Lake in late September, planning to explore eastward the next year. The name of its group of buildings, Fort Confidence, was typical of those used by earlier expeditions.

In 1838 Simpson and Dease reached the western end of Kent Peninsula, near Franklin's most easterly point, but were held up for ten days by gales which packed the ice against the low shores. Finally, Simpson again decided to explore on foot. From the eastern end of Kent Peninsula he could see the unexplored land-mass of Victoria Island to the north and open sea to the eastward. On his return to the boats, however, Dease and the men believed that it was too late in the season to continue.

Unfortunately, many years were to pass

before explorers realized that late August and September were the best months to navigate the Arctic Coast. Since winter was beginning on the land by mid-September, expedition leaders always had to worry about their safe return to winter quarters before this time. It was strange that Hearne's method of living and travelling with the natives was not used again for several decades. Explorers continued to wear their impractical European clothing and to carry most of their food.

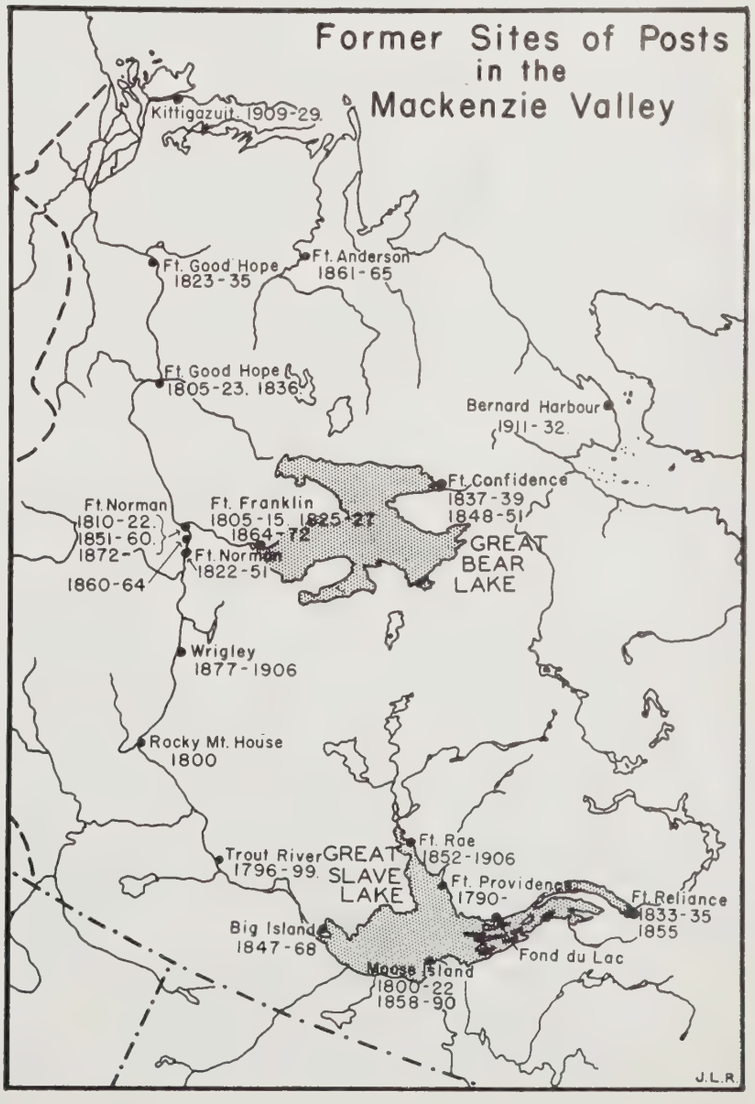
After wintering at Fort Confidence, Simpson and Dease returned to the Arctic Coast in 1839. Although there was loose ice in Coronation Gulf, the explorers were persistent and worked eastward past Kent Peninsula. They mapped the unexplored shore of Queen Maud Gulf, finally linking up with Back's work of 1834. Simpson wished to continue eastward of Chantrey Inlet to see if the land to the north (now King William Island) was connected with the mainland of Boothia Peninsula, but Dease soon decided that they must turn back. On the return trip the expedition traced parts of the south shores of King William Island and Victoria Island. The journeys of Simpson are among the longest performed in small boats in the Arctic. With his work, the earlier explorations were all linked and the northern coast of America was mapped from Boothia Peninsula to Alaska.

Much of the success of these early pioneer journeys was due to the type of shallow-draft boat used, and to the sheer manual labour of the French-Canadian and British boatmen, who rowed and hauled their frail craft through ice-floes and over shoals. The mapping of the western Arctic Coast should be considered in connection with the whole programme of Arctic exploration. The latter included numerous sea voyages into the Eastern Arctic. (6) The overland and coastal journeys in Mackenzie District were actually delimiting the southern line for those seeking a northwest passage from the east.

Other expeditions entered Mackenzie District in the following decades, chiefly aiding in the widely publicized search for Franklin, but they generally followed the previously known routes. Among the latter were the journeys of Richardson and John Rae west of the Mackenzie Delta in 1848, and the completion of the mapping of the south coast of Victoria Island by Rae in 1851. On the mainland, one of the most notable trips was that made by J. Anderson and J. Stewart of the Hudson's Bay Company down Back River to its mouth in 1855.

The success of the first exploratory expeditions must be credited partially to the fact that there were several trading-posts established in the region. These centres, with their connecting transportation systems, were used as bases of supply and were available as a retreat in case of winter difficulties. During the exploratory period the location of the posts changed several times, and new ones were gradually added to give wider contact with the Indians. (See the accompanying map of former post sites.)

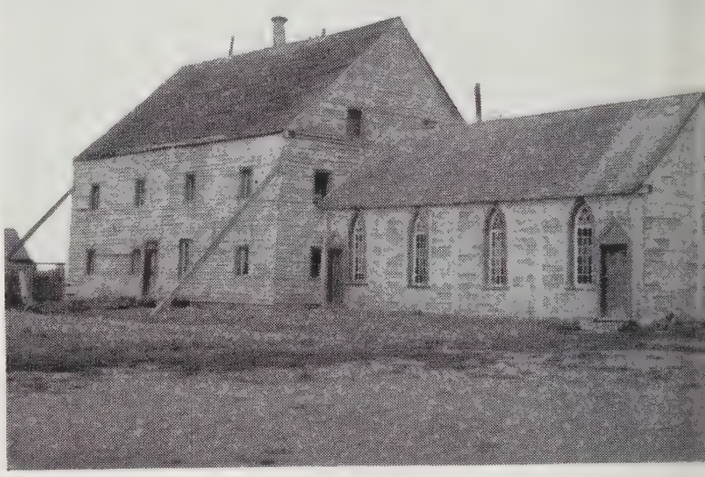
Since the early post factors had to depend a great deal upon the resources of the country





Left:—The Church of Englan mission buildings at Aklavi with church on the left, ho pital in centre and residenti school on the right.

Below:—The old origin Roman Catholic mission buil ings erected at Fort Provi ence in 1862. The church the right was still standing 1945.
Bureau of N.W.T. & Y.A. pho taken in 19



to augment their scanty provisions, one of the primary considerations in locating a post was nearness to good fishing or hunting grounds. In addition, good fishing sites were frequented by the Indians and were thus centres to which they would assemble, bringing in their winter's fur catch. By 1852 there were eight trading-posts scattered along the main waterway, served by annual York boat brigades. The only white residents in the region were those who handled the fur trade or were associated with it.

Missionary Activity, 1852-1900

After the middle of the nineteenth century changes came to the Canadian Northwest. As was typical of the history of pioneering, missionaries followed the traders. Their mission churches and houses, and later their schools and hospitals, gave a greater degree of permanency to the post settlements.

In 1852 Father Faraud of the Roman Catholic Mission at Fort Chipewyan visited Fort Resolution. In 1858 two missionaries entered the area to establish permanent centres. Father P. Grollier came to Moose Island, near Fort Resolution, where a mission had been established by Father Eynard in the spring. (11) In the same year Archdeacon Hunter of the Church of England resigned his charge at Red River and accompanied one of the Hudson's Bay Company brigades north to Fort Simpson. Next summer Rev. William Kirkby replaced Hunter at Fort Simpson and built the first church and dwelling there. Also, in 1859 Father Grollier accompanied the Hudson's Bay Company brigade as far north as Fort Good Hope, near which he built a mission at the mouth of Hare Indian River.

During the following years much of the work of the missionaries was accomplished by long patrols and visits during both summer and winter. Many of their "missions" did not have permanent residents or buildings until several years later. Gradually, however, churches were erected, adding to the size of the tiny posts. In the history of missionary activity in Mackenzie District there are many men who performed long and faithful service for their cause under primitive conditions very different from those of present life in the Valley. In the field of exploration and travel, two missionaries were outstanding among their brethren—Bishop Bompas and Father Petitot.

Rev. W. C. Bompas arrived at Fort Simpson in 1865 to assist Mr. Kirkby with the Anglican missions. In 1866 it was agreed that Bompas would be given a roving commission. During the next few years he travelled widely throughout the region from the Peace River area to the Arctic Coast. During 1870, for example, his travels exceeded 4,000 miles, either by canoe or snowshoes—distances which had never been attempted by anyone previously in such a short period. (12) In 1874 Mr. Bompas was made Bishop of the newly formed Diocese of

Athabaska, and established his headquarters at Fort Simpson. In the succeeding years he continued his wide travels among the Indians until transferred to the Yukon in 1891.

Father Emile Petitot was one of the priests who helped to build the Providence Mission in 1862. Three years later he was stationed at Fort Good Hope, and for the next decade travelled extensively in the Great Bear Lake area.[13] He mapped much of the area around Lake Colville, and even penetrated into Eskimo country almost to the mouth of Anderson River. Credit is due to Father Petitot, not only for his missionary work, but also for being one of the notable explorers in the north-central part of Mackenzie District. His several books on geography, ethnology and travel comprise a valuable contribution to our knowledge of the character of this region.

The exploits of these two missionaries typify the work which was being done by the two churches in the District. With their coming more buildings were added to the small posts, and when the Indians also started to build summer cabins near the missions, the nuclei of settlements took shape. During the last part of the nineteenth century missions were opened at every post throughout the District from Fort Smith to Herschel Island, completing the first major advance in settlement growth. Since new trading-posts were also opened during this period, there was, in 1900, a line of thirteen settlements throughout the Mackenzie Valley, connected by steamer transportation.

Alexandra Falls on Hay River; this striking waterfall was named by Bishop Bompas during his extensive travels in 1872. Note the present winter road to the right of the river.

Photo by K. Perry



Scientific Exploration, 1850-1900

While missionaries and traders were establishing their permanent centres of activity throughout the District, there were other men who entered the area purely for exploratory purposes. After 1850, when the major geographic features of Mackenzie District were known, exploration followed a different theme. The incentive was no longer the thrill of first discovery or the urge to penetrate into the unknown. Travel and exploration followed broader scientific lines. Exploration became a search for knowledge—a search which slowly accumulated facts concerning botany, wild life, geology and similar branches of descriptive science, until Canadians began to realize faintly that this region was not all as desolate and wild as they were wont to picture it.

Among the trained and amateur scientists who assembled information about bird life and botany of Mackenzie District, two of the most notable were Robert Kennicott (1859-62) from the Smithsonian Institution,[14] and Roderick MacFarlane (1862-65) of the Hudson's Bay Company.[15] Animal life, especially musk-ox, in the area north and east of Great Slave Lake, was investigated by Warburton Pike (1889-90),[16] Frank Russell (1892-94), Caspar Whitney (1895) and C. J. Jones (1898).

Extensive botanical and geological notes were made by David Hanbury in 1899 when he discovered a new route from Hudson Bay to the Mackenzie Valley via the Thelon River. In the spring of 1902 Hanbury and a group of Eskimo crossed overland by dog-team from Baker Lake, Keewatin District, to Pelly Lake on Back River, continuing on to the Arctic Coast. Hanbury was thus the first white man to cross this interior region,* and throughout the journey lived principally on caribou, which were then migrating northward.[17]

*Hanbury's route was similar to that followed by the Canadian Army's "Musk-Ox" snowmobile expedition.

There were many government-sponsored explorations during this same period which, although primarily geological in character, resulted in excellent descriptive reports of flora, fauna, and other resources.* One of the first regional studies of the Mackenzie Valley was made by R. G. McConnell of the Geological Survey of Canada, who spent the seasons of 1887-88 travelling throughout the Valley. In the summer of 1888, William Ogilvie, Dominion Land Surveyor, crossed from the Yukon, passing McConnell near Fort McPherson, and ascended the Mackenzie, making careful notes as he travelled. In 1891, Ogilvie journeyed down the Athabaska, Slave, and Mackenzie Rivers to Fort Simpson, and from there ascended the Liard and Nelson Rivers. His report contains some of the earliest descriptive material of the southwestern part of the District.

The southeastern part of Mackenzie District was explored in 1893 by J. B. and J. W. Tyrrell of the Geological Survey. They portaged from the east end of Athabaska Lake to the headwaters of Dubawnt River, and became the first white party to traverse this central section of interior Canada to the head of Chesterfield Inlet. In 1900 J. W. Tyrrell followed Hanbury's route east from Great Slave Lake and alone explored much of the interior country east of Artillery Lake.

In the summer of 1899 Dr. Robert Bell, and his nephew, J. Mackintosh Bell, investigated the geology of the North Arm of Great Slave Lake. After wintering at Fort Resolution, J. M. Bell proceeded north to Fort Norman, where he was joined by Charles Camsell. Their geological party then travelled along the shores of Great Bear Lake in the summer of 1900, and noted the famous "stains of purple, red and brown" which were later to lead to the discovery of pitchblende.

By the turn of the century Mackenzie District was no longer an unknown country. As news of gold in the Yukon travelled south, prior to the Klondike strike, prospectors and other hardy adventurers turned their eyes to the North. The good water route north of Edmonton through the Athabaska and Mackenzie Valleys was known, and this broad trail, linked with the crossing from Fort McPherson to Porcupine River, became the "back door" to the Yukon. Since more and more people were entering the area, some of whom remained to trap or trade, the pioneer land was ready for the next step in its evolution—the coming of some form of supervision and government.

*Published in the Annual Reports of the Geological Survey of Canada.

TWO PRESENT-DAY R.C.M.P. DETACHMENTS

R.C.M.P. at Fort Smith. The buildings are situated in the centre of a nine-hole golf course.





R.C.M.P. at Fort Providence. Dwelling is seen in the centre and dog-kennels to the right.



Residences constructed by the Imperial Oil Co. Ltd. for single girls at Norman Wells.

Royal Canadian Mounted Police

The Royal Canadian Mounted Police (then the North West Mounted Police) were formed in 1873 with the duty of maintaining the law in the vast areas of the Northwest, recently acquired from the Hudson's Bay Company. Throughout the following two decades the "Mounties" were the chief governing officers in the Prairies during the hectic years when settlers were pouring into the fertile lands. Their work gradually spread northward, and in 1895 a police post was established in Yukon District. The increasing flow of prospectors to the Yukon was actually the reason for the first police penetration of what is now Mackenzie District.

During the winter of 1897 Inspector A. M. Jarvis led a pioneer patrol north from Fort Saskatchewan (near Edmonton) along the Athabaska and Slave Rivers to Fort Resolution to check on itinerant trappers and to prevent carelessness of travellers in starting forest fires. In 1902 the force moved one more long step northward when a detachment was placed at Fort Chipewyan. From there several patrols covered the southern part of Mackenzie District during the succeeding years.[18]

American whalers, who had extended their operations eastward along the Alaskan Coast, began wintering at Herschel Island in 1890. Their uncontrolled, and often riotous, activities during the next decade led to reports which necessitated investigation. In the summer of 1903 Sgt. F. J. Fitzgerald boarded the *S. S. Wrigley* at Fort Smith and travelled downstream to the Hudson's Bay Company's most northerly post at Fort McPherson. He continued by canoe to Herschel Island and issued instructions to the whalers regarding customs and liquor regulations. Fitzgerald returned to McPherson in the autumn to open a detachment there, and in the following summer established the most northerly police post on Herschel Island. During the succeeding years, officers from these two centres administered all of the northern part of the Mackenzie Valley and the nearby Arctic Coast.

In the southern part of the District, the police placed a detachment at Smith's Landing (now Fort Fitzgerald) in 1908 to protect the buffalo herds west of Slave River. In the following years patrols visited the growing settlements of southern Mackenzie District. In 1913, however, it was decided to locate detachments at Forts Resolution and Simpson to reduce the long distances travelled. In 1916 a detachment was established at Fort Norman to connect the northern and southern patrols.

Space does not permit mention of all the long and important patrols made by the police officers during the years prior to 1921 when they were responsible for the administration of the region.[19] One of the most famous annual patrols was that through the northern Mackenzie Mountains from Dawson City, Yukon, to Fort McPherson via Peel River. The difficulty of this patrol, through an area where game was uncertain, was illustrated in 1911 when Inspector Fitzgerald and his three companions became lost and starved to death. The longest overland patrol of the police took place in 1917 from Baker Lake across the Barren Grounds to the Arctic Coast, and thence westward to the headquarters of a trader at Bernard Harbour, north of Coppermine. On the return trip the police were on the verge of starvation several times, but each time were able to kill a few caribou or musk-ox just when the situation seemed almost hopeless.

The end of the period of unorganized development saw the police located at a few strategic places along the Mackenzie Valley and Arctic Coast, thereby controlling the main transportation routes, so that they knew who entered or left the region. By



Panorama of Hay River settlement, looking south from the Roman Ca

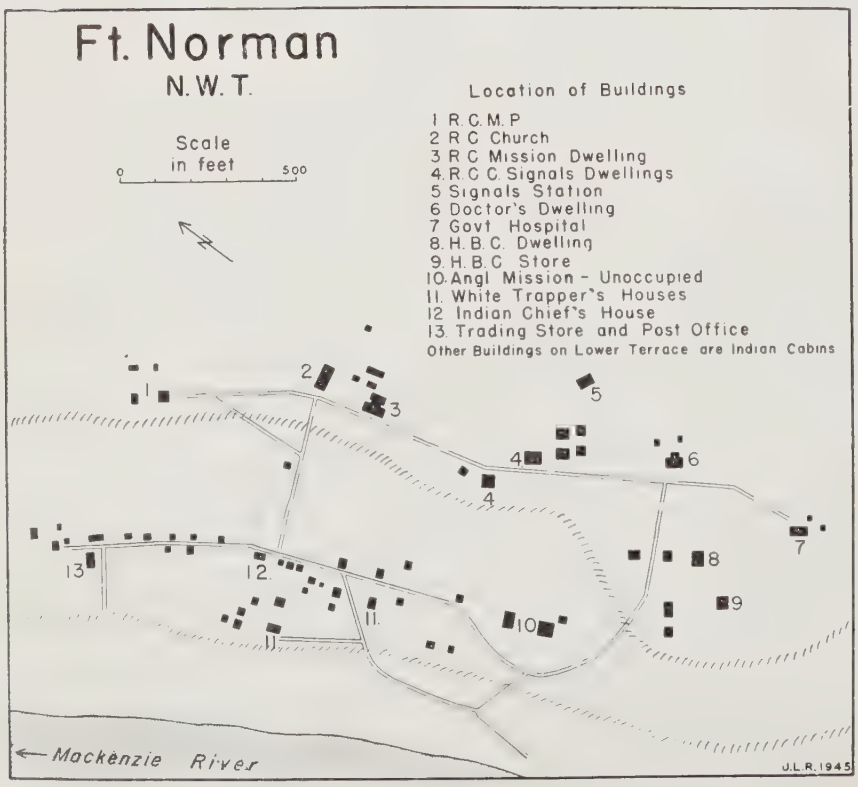
CHRONOLOGY OF FIRST SETTLEMENT IN MACKENZIE VALLEY*

Settlement	Trading Posts**	Missions	R.C.M.P.
Fort Smith	H.B.C.—1874	R.C.—1888. Ang.—1929	1921
Fort Resolution	N.W.C.—1786–87	R.C.—1858	1913
	H.B.C.—1804	Ang.—1890–95	
Fort Reliance	H.B.C.—1833–35		1927
Rae	H.B.C.—1852	R.C.—1872. . Ang.—1876–1880	1924
Hay River	H.B.C.—1868	Ang.—1893. . R.C.—1900	1925–33
Fort Providence	H.B.C.—1868	R.C.—1862	1924
Fort Simpson	N.W.C.—1804	Ang.—1858	1913
	H.B.C.—1820 (1822)	R.C.—1894	
Fort Liard	N.W.C.—1805	R.C.—1871. . Ang.—1887–92	1929
Fort Wrigley	H.B.C.—1877	R.C.—1897	1932–33
Fort Norman	N.W.C.—prior to 1810	Ang.—1866–68, 1876. . R.C.—1876	1916
Fort Franklin	N.W.C.—1805–15		
	H.B.C.—1825–27, 1864–72		
Fort Good Hope	N.W.C.—1805	R.C.—1859	1924
Arctic Red River	H.B.C.—1891	R.C.—1896	1926
Fort McPherson	H.B.C.—1840	Ang.—1876. . R.C.—1890–96	1903–22
Aklavik	H.B.C.—1912	Ang.—1919	1922
	N.T.C.—1912	R.C.—1926	
Herschel Island	Whaling—1890–1914	Ang.—1896–1903	1904–1936
	H.B.C.—1916		

N.W.C.—North West Company
H.B.C.—Hudson's Bay Company
R.C.—Roman Catholic
Ang.—Anglican
R.C.M.P.—Royal Canadian Mounted Police
N.T.C.—Northern Trading Company

*Dates given usually refer to the establishment of permanent buildings. In some cases visits were made prior to this, and frequently the buildings were later abandoned. For changes in sites, or posts which were abandoned, see map on page nine.
**After amalgamation in 1821, many N. W. C. posts were occupied by the H. B. C.

means of their long patrols in summer and winter they linked their work and covered most of the populated sections of the District. By the end of 1920 detachments were patrolling from Forts Fitzgerald, Resolution, Simpson, Norman, McPherson, Herschel, and from Tree River.



During the first two decades of the present century numerous independent traders entered the Mackenzie Valley. Some settlements had as many as three or four trading stores at one time. The leading concern in opposition to the historic Hudson's Bay Company in 1905 was the Hyslop and Nagle Trading Company, which had stores located in seven settlements, and operated its own steamer. Eight years later this company was bought by the Northern Trading Company, which soon placed posts throughout the Valley as far as Aklavik. Competition was keen in those years and the police were kept busy controlling trading and trapping practices.

The various dwellings, offices, and warehouses which were erected by the police and traders from 1900 to 1920 helped to swell the size of each tiny settlement. Whereas the original post consisted solely of a trading



Compare this picture with the map of buildings at the settlement.

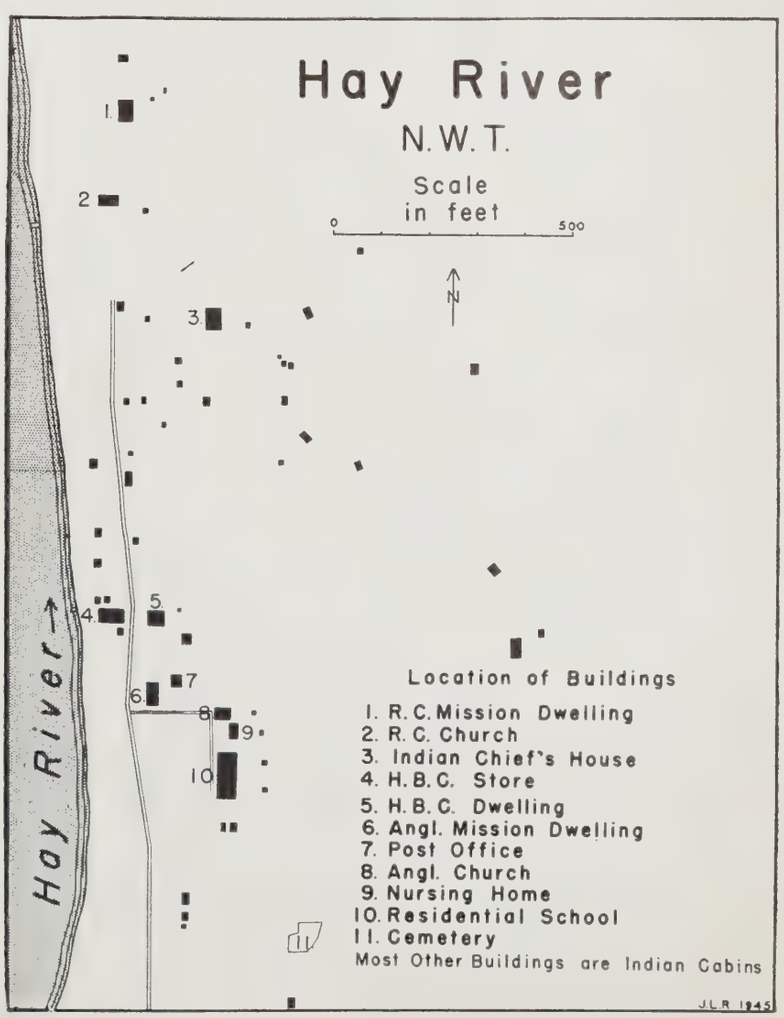
store and a group of Indian tents, the settlements of 1920 had a cluster of white men's residences of various kinds and numerous Indian cabins. Although southern Canadian towns also went through these same stages of adding organizations and buildings step by step, their expansion period often lasted only a few years. In Mackenzie District the slow growth of the original post to the status of a small settlement was measured in decades rather than years. (See the chart of first settlement on preceding page.)

Western Arctic Settlement

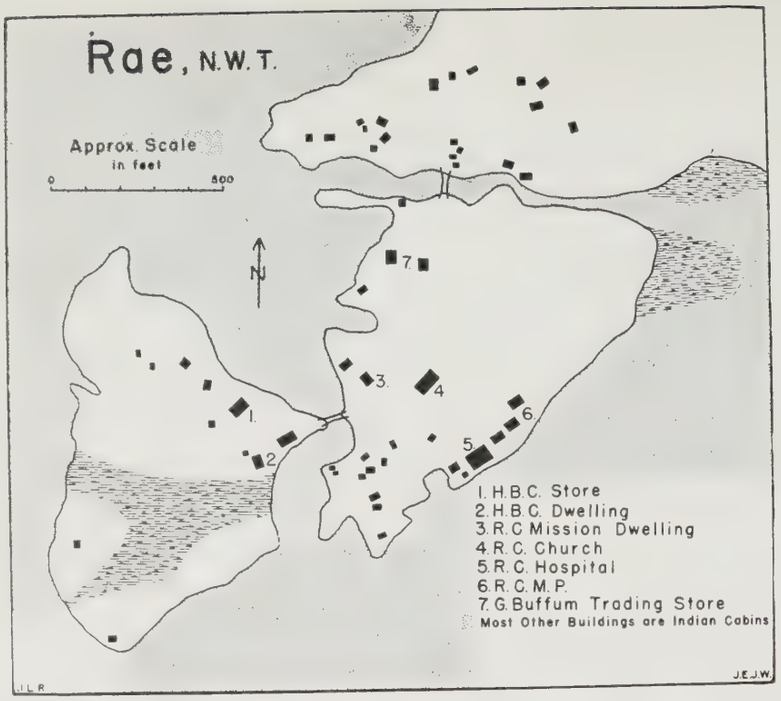
Soon after river-steamers reached the Arctic Coast, small coastal motor-vessels began moving eastward from the Mackenzie Delta area. Traders seeking white-fox pelts from the natives were first to settle permanently in Eskimo country, and they were followed by missionaries. Trading with the Eskimo was carried on by the whalers wintering at Herschel Island and Baillie Island, and by 1906 Captain C. Klengenberg had penetrated as far east as the coast of Victoria Island. A few years later Captain J. Bernard had located a store at Bernard Harbour (1911-14). By 1920 several traders and the Hudson's Bay Company were operating along the coast of Coronation Gulf as far east as Kent Peninsula. An Anglican Mission was established at Bernard Harbour in 1916, and in later years missions were opened at other Western Arctic posts (Cambridge Bay, 1927; Coppermine, 1928).

It was in order to supervise the increasing activity of the traders that the R.C.M.P. decided that they should move closer to the area. In 1919 a detachment was opened at the good harbour of Tree River, east of Coppermine River. From here patrols were made along the Arctic Coast and across to Victoria Island. The number of detachments was increased in the following years to complete a line of police posts along the Arctic Coast: Baillie Island, 1923; Bernard Harbour, 1926; Pearce Point, 1930; Coppermine, 1931.* The Tree River detachment was transferred eastward to Cambridge Bay in 1926 to give contact with the isolated Central Arctic Eskimo.

The traders continued their eastward movement along the Arctic Coast of Mackenzie District. In 1926 four trading-posts were opened in Queen Maud Gulf. The difficulties of transporting supplies to the Western Arctic were great, however, and the number of posts has gradually declined in recent years. The present settlements differ in appearance from those in the Mackenzie Valley in that they are much smaller, owing chiefly to the fact that, unlike the Indians,



*See Annual Reports of the Royal Canadian Mounted Police—"Control of the Northern Regions".



Eskimo do not build permanent homes around the posts.

Present-Day Settlements in the Mackenzie Valley

After more than a century of slow development, history began to move faster in Mackenzie District following 1920. This increasing tempo was due largely to better transportation facilities, which meant that more people could enter the area. In March, 1921, the first aeroplanes reached Fort Simpson, landing on skis, and that summer a float-plane was flown north to Norman Wells. By 1925 the railroad from Athabaska Landing was extended north to Waterways. In the same year wireless communication, operated by the Royal Canadian Corps of Signals, was established from Aklavik, Fort Simpson and Fort Smith. In the succeeding years this network was expanded until now every settlement has daily radio-telegraph communication with other parts of the world. By 1928-29, commercial air transport companies had entered the District in force to assist prospectors. The great strides in aviation made during the next decade were among the chief factors in bringing Mackenzie District into the limelight.

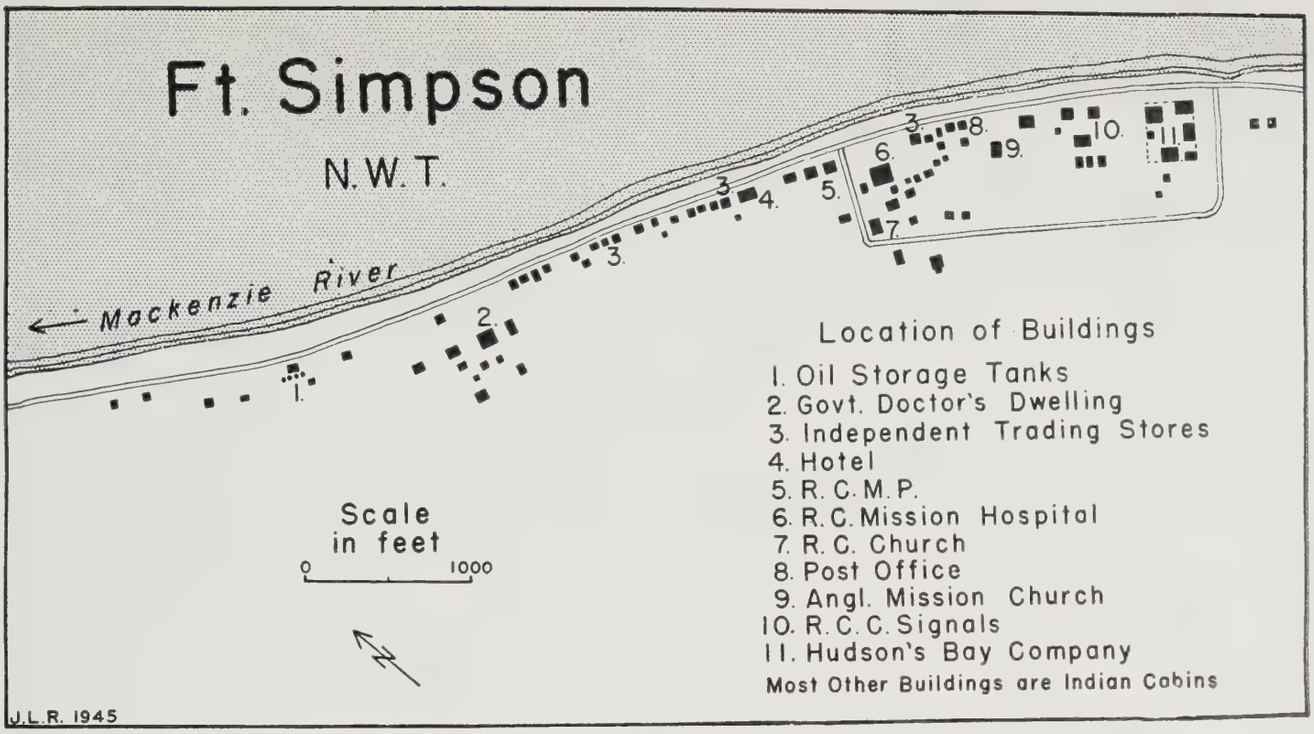
Present-day settlements in the Mackenzie Valley range in size and function from tiny Wrigley, which has remained solely a trading-post, to busy, booming Yellowknife, a modern town of over 2,000 inhabitants. To describe each of these settlements in detail would result in needless repetition, and the reader is referred to the accompanying pictures and settlement maps which show the sizes and types of buildings at several of the centres.

Some of the settlements can be grouped together as similar. Hay River, Providence, Liard, Norman, Good Hope and McPherson are linear-type settlements, extending along the river bank. They all contain the Police, Signals, trading, and missionary buildings, and a scattering of Indian cabins. There are from 10 to 30 white residents at each settlement, and, in the surrounding area, from 200 to 300 Indians who come into the settlement from time to time.* The settlements of Fort Resolution and Rae have grown up as a cluster of buildings grouped on the lake shore rather than spread out along a river. Fort Simpson and Aklavik are larger villages of the linear type, having more trading stores, a hotel, restaurant, and several resident white trappers. In all, there may be from 50 to 100 white residents in each of the latter settlements, and they have a social life similar to that of small towns in southern Canada. Fort Smith is still larger, containing Government administrative offices, and the warehouses and offices of the transportation companies. It has the beginning of a street pattern and is connected with nearby Bell Rock and Fort Fitzgerald by all-weather roads.

Norman Wells and Port Radium might be classed as company settlements controlled respectively by the Imperial Oil Co. Ltd. and Eldorado Mining and Refining. All of the residents dwell in comfortable, well-equipped buildings supplied by the companies, and their business is concerned solely with the companies' work. The population of these settlements varies according to the amount of activity at the oil wells or pitchblende mine, and is at present about 200-350, including women and children.

Yellowknife is the largest settlement in Mackenzie District. It came into boom-town existence in 1935-36 following the rich gold strikes in the area. Unlike similar gold-rush towns of a few decades ago, Yellow-

*Total population of the Mackenzie Valley in 1941 was 2,063 white residents and 4,322 Indians.



knife has had lawful, orderly, progress. In 1939 the Yellowknife Administration District was created and the first municipal government of Mackenzie District was established in the following year. The population of over 1,000 was clustered in variegated frame buildings around the knoll of a rocky peninsula jutting into Yellowknife Bay. In 1941-42 there were six producing gold mines in the area, but a shortage of labour gradually forced them to suspend operations temporarily.

In 1944 a new rush to the Yellowknife area followed reports of discoveries on the Giant Yellowknife property. By 1945 there was a population of about 3,000 in the town and surrounding prospecting area, and there was an infectious spirit of busy optimism and friendliness about the settlement. The town was very crowded, however, and although Yellowknife tried to satisfy the needs of this most recent influx with the well-known friendly hospitality of Mackenzie District, it was impossible. The townsite had outgrown its location, and a new site was surveyed in 1945 on a level area about two miles distant from the present settlement.

Yellowknife is a mining town similar to many others in the Canadian Shield of Northern Ontario or Manitoba. It has daily plane service in summer from Fort Smith and Edmonton, and supplies are shipped in by boat in summer and by tractor-train in winter. To serve the local population, there are numerous restaurants, banks, general stores, barber shops, etc.*

Yellowknife is an example of how small settlements like those in Mackenzie District can grow in importance and size if some resource is found to assist historical evolution. If history and geography are combined one has a sound basis for understanding the reasons for growth and the future possibilities of a settlement. Certain sites were picked because of their strategic locations which opened the way to new regions; other locations were chosen because of their resource possibilities—chiefly good fishing or hunting.

Once the location of a post had become history, its normal growth depended upon new organizations entering the area. To expand beyond normal, however, necessitated some nearby resource which could be developed. Thus, Fort Simpson and Aklavik are larger than the other trading settlements because they are located in areas richer in furs. Similarly, owing to the barrier of the rapids in Slave River, Fort Smith became a transportation terminal and surpassed the settlements which depended mainly on fur. Finally, when a resource such as gold, pitchblende, or oil was found to compete in the world market, larger numbers of people assembled in the area to extract the wealth, and thus still larger settlements evolved. The history of a settlement explains its background and functions; the geography of the region in which the settlement is located points the way to its future.

*Prospective visitors and residents may obtain more detailed information concerning Yellowknife and facilities from the Bureau of Northwest Territories and Yukon Affairs, Dept. of Mines and Resources, Ottawa.



The settlement of Fort Simpson on Mackenzie River; Anglican Mission in foreground, hospital in left background



Aerial view of radium and uranium mine at Port Radium, Great Bear Lake, N.W.T.
National Film Board photo



Royal Canadian Corps of Signals station at Fort Norman in centre, Doctor's residence at right, scenic Bear Mountain in background

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*For those readers interested in early history and exploration the authors recommend the original journals of the explorers.

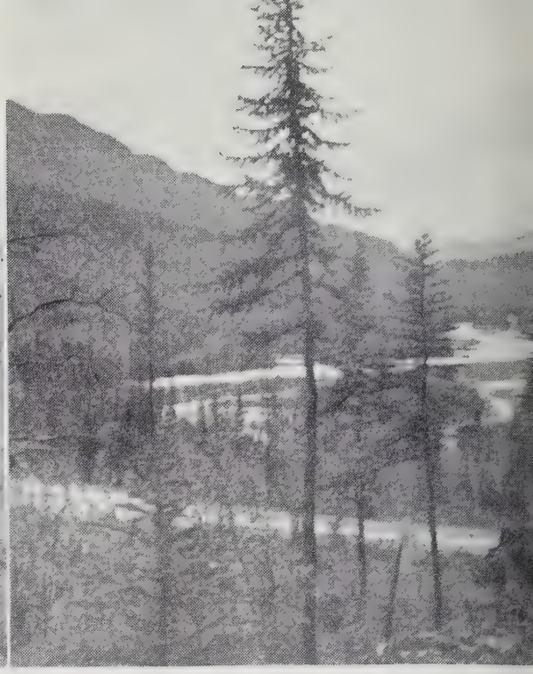
LAND USE POSSIBILITIES in Mackenzie District, N.W.T.



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The barren peaks and ridges of the Mackenzie Mountains, at the headwaters of Root River Photo by Eric Fry



A scenic view up the Twitza River Va Mountains

Land Use Possibilities In Mackenzie District, N.W.T.*

by J. LEWIS ROBINSON

WARTIME activity and apparently rich mineral strikes in recent years have focused the attention of Canadians upon their northwestern domain. They want to know the extent and potentialities of the resources in the regions beyond the 60th parallel of latitude, particularly in the promising Mackenzie Valley.

Fur resources were primarily responsible for the exploration and settlement of Mackenzie District. Although still important, the exploitation of fur-bearing animals appears to have passed its peak, but may be revived by an increased interest in fur farming. Any future increase in population will probably be a result of the expanding mining industry, the present backbone of development. As a basis for a permanent population, however, soil resources have an important role in future development. What the region will produce and what use may best be made of the land are fundamental problems for interested Canadians.

An accurate picture of the land use possibilities can be obtained through a study of the controlling geographic factors of soil, topography and climate. These possibilities may be limited to certain phases in Mackenzie District. The best soils, if they are near adequate markets and transportation, will be utilized for general farming. Since these markets are generally lacking at present, local gardening has become the chief utilization of the soil resources of the District. The development and expansion of horticulture can do much to improve the welfare of the white and Indian inhabitants for undoubtedly many of them suffer from diet deficiencies. There are also areas of good soils which support excellent forest growth. Since timber resources are also necessary for any future expansion of population, many of these forested areas should be so maintained rather than cleared for agriculture. There are other sections which are not favourable to growth of merchantable timber nor suitable for agriculture. These stunted forests will always be of some economic value as protection for the game and fur animals upon which the native and white trappers depend for a living. Finally, there are vast barren areas suitable only for reindeer and caribou pasturage. Future planning must balance all of these

*Prepared at the Bureau of Northwest Territories and Yukon Affairs, Department of Mines and Resources, for the Interdepartmental Committee on Agriculture in Northwestern Canada.



the Canol Road in the Mackenzie
Photo by C. A. Duncan



"Canada's Burma Road"—supply trucks crawl along the Canol Road through the Mackenzie Mountains above tree-line.
Photo by C. A. Duncan

factors and determine the best use of the land by considering the geographic and economic facts which control land utilization.

Topography and Soils

The only extensive areas of level land are found in the valleys of the broad Mackenzie River and its tributaries. From Fort Smith, on the southern border of the District, the Mackenzie River system extends northward for about 1,360 miles to Aklavik, flowing through a generally broad, flat valley varying in width from a few miles to about 40 miles. Although the Mackenzie Valley is the narrow northern continuation of the Great Central Plains physiographic region, which constitutes much of the Prairie Provinces, a great deal of the lowland is not arable because of large areas of lakes, muskegs, and poorly drained soils.

The eastern part of Mackenzie District is underlain by the scoured hills and ridges of the ancient Canadian Shield. Scattered glacial deposits which have not yet become soil, poor drainage, and, in the far northeastern part, severity of climate, have all combined to discourage vegetative growth on the Precambrian rocks of the Shield. To the west of the Mackenzie lowland, the jagged, bare-topped, picturesque peaks of the Mackenzie Mountains rise abruptly above the valley. This rather inaccessible range forms part of the boundary and is also a barrier between Mackenzie District and Yukon Territory. Except for the Liard River Valley at its southern end and the Peel River in the north, the Mackenzie Ranges are traversed only by the recently constructed Canol Road and oil pipeline from Norman Wells to near Whitehorse, Yukon Territory.

Between the two flanking rugged areas, which are very different in topographic appearance, lies a lowland of sedimentary rock of Palaeozoic age, covered by deposition washed into the valley during the Glacial age. On top of the hundreds of feet of boulders, gravel and sand, post-glacial rivers have deposited a finer mantle. The broad Mackenzie River has incised a channel through the unconsolidated material, and flows between generally high banks of gravel and clay. Tributaries such as the Athabaska, Peace, Slave, Hay and Liard Rivers carry large amounts of silt in their waters and have built up flood plains along their courses and formed deltas at their mouths.

In many areas throughout the Mackenzie Valley there are sections of alluvial soil which have favourable physical properties for agriculture and forests. The Slave River, from the rapids at Fort Smith on the 60th parallel of latitude to Fort Resolution near its delta on Great Slave Lake, follows a meandering course through an alluvial lowland. The western boundary of the Canadian Shield parallels the Slave River a few miles to the east, but westward the semi-open wooded plain rises gradually towards the Caribou Hills in Wood Buffalo Park. Local areas such as that in the vicinity of the St. Bruno Mission, 20 miles west of Fort Smith

on the Salt River, have good agricultural possibilities, but only a small proportion of the remainder of the plain is suitable owing to swamps and sandy or gravelly ridges. At Fort Smith settlement the soil is quite sandy but along the lower course of the Slave River there are areas of deep clay with sandy ridges.

Some of the chief stands of merchantable timber in Mackenzie District are found along the Slave River. There are also many young stands of high potential value, which make the strip an important one for future development. Most of the timber used at Yellowknife and Fort Resolution has been cut in this area and floated downstream. Future land use practices will undoubtedly maintain many of these good agricultural soil areas for reserve timber.

West of the Slave River delta the south shore of Great Slave Lake is low and rises gently to a limestone escarpment which marks the northern edge of the Cameron Hills. The lowland is wooded and fairly level, with occasional swamps and several areas of grassland. The best alluvial soils are found at the mouths of rivers, the most extensive of which are at Hay River settlement. Good agricultural land has been reported farther south along the Hay River Valley but this area needs further investigation.

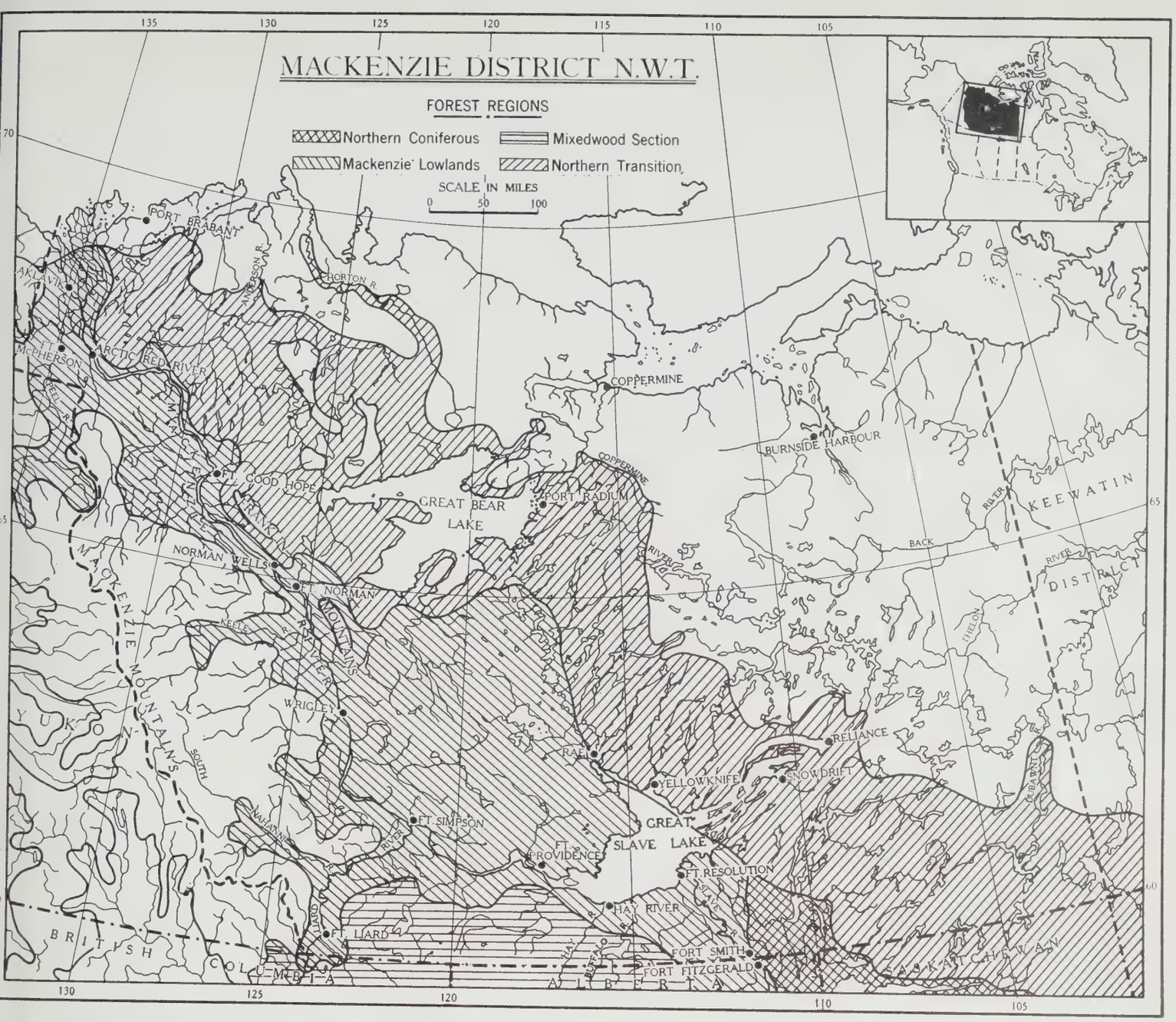
The eastern sections of Great Slave Lake are in the Precambrian rocks of the rugged Canadian Shield. In general the area is one of innumerable lakes separated by stretches of scrub timber or exposed bedrock. Although there are local areas of clay and sand marking former lake and stream deposits, most unconsolidated materials (muskeg, glacial drift, and immature soils) are limited to local depressions in the bedrock surface. Such glacial soil deposits are variable as to depth, texture, and reaction. Some fair stands of timber, useful for mining purposes, are present in the more sheltered depressions, but the remaining forest cover is generally stunted.

West of the north arm of Great Slave Lake and north of the Mackenzie River the lowland is interrupted by the flat-topped plateau of the Horn Mountains which rises to altitudes of about 2,000 feet. Northward the muskeg and lake-dotted plain extends to Great Bear Lake and is separated from the main Mackenzie lowland on the west by the Franklin Mountains. Near the river much of the land is low, swampy, and wooded with small spruce, tamarack, and swamp birch. The chief settlements in the region are at Fort Providence and Fort Simpson, where limited general farming and successful gardening have been carried on for several decades.

Before the recent increase in population at Norman Wells, Fort Simpson was the largest settlement along the Mackenzie River proper. The village is located on a large alluvial island near the left bank of the Mackenzie River below its junction with the Liard. It contains the largest cultivated acreage of farm land in the Northwest Territories. Other areas of desirable alluvial soil are scattered in the vicinity on small islands and lower river terraces but no single large agricultural area is known.

The Liard River Valley, southwest of Fort Simpson, has good agricultural possibilities. Between Nelson Forks, B.C., and Birch River, river terraces are of almost continuous occurrence, and river bottom lands with good fertile soils occur in extensive blocks. Large alluvial islands are also numerous. Soils are generally a loam overlying a sandy base, and their fertility is reflected in the good growth of vegetation. Within the valley, between Nelson Forks and the Big Bend of the Liard, there are probably about 45,000 acres of river terraces suitable for agriculture, the best of which are south of Fort Liard post. The upland plains, about 300 to 500 feet above the river, may also have agricultural possibilities, but soils which have been developed there, on lacustrine or alluvial deposits, are not quite as favourable as those of the lower terraces.

The Liard Valley, however, is heavily wooded with large blocks of merchantable timber, chiefly spruce, and aspen and black poplar, as well as willow and alder. Since the timber could be floated downstream to



Forest regions of Mackenzie District

Fort Simpson, and from there to the lower river posts, it may play an important part in the future development of the District. Costs of clearing will be high for farming in this area, thus probably classing it as a reserve source of lumber rather than an agricultural centre.

The Mackenzie lowland from Fort Simpson to Fort Norman is an undulating plain lightly clad with spruce in the low areas and jackpine on the sand and gravel ridges. Along the river heavy stands of aspen poplar and birch are often indicative of good soils. Patches of merchantable spruce are scattered along the banks in sufficient quantity for local use but do not occur with sufficient frequency to constitute any considerable reserve.

Along the lower Mackenzie the silt load carried by streams draining from the mountains on both sides has built up local alluvial terraces and islands which are capable of being utilized for any future expansion of gardening activities. Cultivation of the islands, however, is rendered hazardous by occasional flooding following ice-jams.

North of Norman Wells a flat, poorly-drained plain, broken only by a few outcropping limestone escarpments, extends several miles westward from the Mackenzie River before reaching the low foothills of the mountains. Large areas are composed almost entirely of swamp, with a few small shallow ponds; lakes large and deep enough for landings by pontoon-equipped planes are few and far between. Most of the principal rivers of

this area, the Carcajou, Mountain, Arctic Red, and Peel, have cut deep gorges into the surface of the plain.

At Fort Good Hope the river banks rise to 150 feet and are sheer, precipitous walls of limestone rising from 125 to 200 feet at the Ramparts, slightly south of there. The Franklin Mountains decrease in altitude east of Fort Good Hope and the Mackenzie lowland broadens out to the northeast, extending uninterrupted to the Arctic Coast. The Mackenzie River terminates in a low, alluvial delta which is about 100 miles long and 50 miles wide and has numerous streams, channels, and cut-off lakes. Tree growth is found as far north as Aklavik on the delta, but trees other than spruce seldom exceed 20 feet in height. Arable areas are few and occur chiefly on the river banks where drainage is good. Garden produce for local consumption has been raised at the settlements of Fort Good Hope, Arctic Red River, Thunder River, Fort McPherson and Aklavik. Vegetables and green cereal crops raised at the latter place mark the northern limit of horticulture, but land use at Aklavik is limited by the permanent frost layer about 6 to 12 inches below the surface of wooded soils.

Physiographically, Mackenzie District has the long lowland of the Mackenzie River Valley, with an approximate total area of 125,000 square miles, as the only section of potential agricultural land. Within this area, however, there are many sections of undeveloped or poorly-drained soils. Because northern soils are generally low in organic matter, fertilizers are necessary for continual cropping. These factors, combined with severity of temperatures, uncertain rainfall, and permanently frozen sub-soil, restrict land use possibilities even within the lowland.

In soils which are permanently frozen, drainage is not possible and water collects in low places forming lakes of all sizes and shapes. Water then spills from one lake to another with a very indefinite drainage pattern. The permanently frozen zone, which is similar to large areas known in the Soviet Union, is of uncertain total depth, but has been recorded as 100 feet thick at Norman Wells, 175 feet at Yellowknife, and 345 feet at Port Radium. The depth of summer thawing varies according to the type of cover and local soil characteristics. In general, residents of the Mackenzie Valley estimate that thawing extends to about 3 to 10 feet under cultivated soil, only 2 to 3 feet in wooded soil, and is somewhat less under muskeg. Unless thawing extends to about 3 to 5 feet it is believed that there is a repressing effect upon root development. Crops and forests, however, do grow on soils of shallower thawing. Summer melting of frozen soil has one advantage in that it allows a gradual release of moisture which provides some sub-irrigation for growing crops and partially compensates for the inadequate rainfall.

New land could be made available in Mackenzie District by clearing forests and stripping the moss cover, but many of these areas would be away from the river. Experience has shown that the frost danger is less along the river banks where air drainage is more active and where the warmer waters of the northward-flowing river have a modifying effect. More intensive utilization of these areas seems probable before there is much expansion into the interior.

Climate

In addition to topography and soils the climate of Mackenzie District is a further factor determining what may be grown in



The front ranges of the Mackenzie Mountains in the winter Photo by R. Montgomery

the region. Although part of the area is north of the Arctic Circle, that line which was drawn upon the globe by the ancient geographers and mathematicians is not a true climatic line. The Arctic Circle is simply the southern limit of a zone which has one day or more of 24 hours of daylight in a single year; it does not separate the Arctic from the sub-Arctic. An Arctic region is a climatic term and defines an area within which average mean monthly temperatures never rise above 50° F. This climatic line closely coincides with the northern limit of tree growth, so that most Arctic areas are treeless, except for occasional small willows and low shrubs.

Although the Mackenzie Valley has the same latitude as Eastern Arctic areas around northern Hudson Bay and southern Baffin Island, warm air masses from the North Pacific pass over the former region in the summer causing average mean monthly temperatures to rise above 50° F. for the months of June, July, and August. Thus, the Mackenzie Valley, as far north as Aklavik, which is 110 miles north of the Arctic Circle at latitude 68 degrees, is wooded country and sub-Arctic. Since agricultural possibilities are dependent upon climate and not on latitude alone, many of the feats of growing gardens and crops in far northern latitudes are not exceptionally amazing.

Great ranges in annual temperatures are found in the Mackenzie River Valley. Temperatures have varied from an extreme minimum of −79 degrees at Fort Good Hope to an absolute maximum of 103 degrees at Fort Smith. The accompanying climatic charts show that winter temperatures are low. January is usually coldest, with average mean monthly temperatures of −15° to −23° recorded at each settlement. Average daily temperatures rise above the freezing point in late April or early May and the three summer months of June, July and August all have average mean temperatures ranging from 50° F. to 60° F. Despite a range in latitude of about 560 miles between Fort Smith and Aklavik, there is a certain uniformity of







Top:—From the Canol Road looking across the "Plains of Abraham" towards the Mackenzie peaks.
Centre:—Forest growth in the sheltered valley of Little Keele River, mile 60, Canol Road
Bottom:—Looking westward over the Mackenzie Lowland along the course of the Keele River, west of Fort Norman. Photo by C. A. Duncan



Looking eastward across the Mackenzie Lowland. Steep banks of Carcajou River in foreground
Photo by Eric Fry

average summer temperatures which extends throughout the whole valley. Extreme maximum temperatures of 90° or more have been recorded at all stations except Aklavik, but average summer monthly maximums of 80 to 85 degrees are more usual. These figures illustrate that the Mackenzie Valley can be hot in the summer despite its northerly latitude.

The average frost-free period varies greatly owing to local differences in topography and air drainage. The extreme range is a minimum of 44 days at Fort Norman and a maximum of 92 days at Fort Resolution. Latest spring frosts usually occur around mid-June at most stations. This early average is similar to that of June 12 recorded in the known agricultural area at Fort Vermilion, northern Alberta. Spring planting in Mackenzie District usually precedes the average last spring frost; it is done in the third week of May in the Great Slave Lake area and carried out during the last part of May at the lower Mackenzie River posts.

There is greater irregularity in the occurrence of first fall frosts, which vary from early August to early September and are instrumental in killing the grain crops in certain seasons. At most stations there is a range of 50 to 60 days from the time the earliest fall frost has been recorded to the time of the latest fall frost. This precarious situation is the key to the future of agriculture in the Mackenzie Valley, and has been one of the factors placing the present northern limit of successful grain growth at Fort Simpson. The graphs at the bottom of the accompanying climatic charts illustrate the average frost-free period at each station, and also the maximum and minimum frost-free range.

Growth in the Mackenzie Valley is greatly influenced by the long duration of sunlight during the summer months. There is not continuous daylight at all the centres, as is often believed, but there are long hours of light, with correspondingly warm temperatures, which greatly assist rapidly-growing crops. The duration of sunlight (sun above the horizon) at certain of the posts during the summer is illustrated as follows:

HOURS OF SUNLIGHT

Place	Latitude	June 15	July 15	Aug. 15	Sept. 15
Ft. Smith	60°	19	18	15¾	13
Ft. Simpson	61° 52′	19½	18½	16	13
Ft. Norman	64° 55′	22½	20	16¾	13
Ft. Good Hope	66° 15′	24	21½	17	13¼
Aklavik	68° 13′	24	24	17¾	13½

A low average annual precipitation of 10 to 13 inches is also a factor controlling agricultural possibilities. Although popularly pictured as a region of deep snows, the Mackenzie Valley actually receives less than one-quarter of the snowfall recorded at Ottawa, but slow evaporation allows it to remain on the ground throughout the winter. Forty to fifty per cent of the total precipitation falls as rain during the four summer months. As the accompanying charts illustrate, this summer precipitation, averaging 1 to 2 inches per month, is a precarious total and drought years have been one of the serious problems for both gardens and field crops. In dry years gardens have been irrigated or watered from the plentiful supply in the river, but the high banks which generally prevail have meant that irrigation increases costs for labour or pumping.

Early fall freeze-up of the Mackenzie River, which commonly occurs in middle or late October, is one of the problems facing local sections which now produce a surplus of agricultural and garden products for other areas. Since the river-boats are usually wintered at Fort Smith, and the Mackenzie route is long, the last boat going north passes Fort Simpson in late August and about the third week in September coming south. Thus, excess produce, chiefly potatoes at present, must be ready for shipment at these times. The settlements on the south shore of Great Slave Lake and along the Slave River have better transportation connections to Yellowknife, the chief local market. Their more favourable geographic location is an advantage for future agricultural expansion.

Historical Background

Exploitation of the fur resources of the Mackenzie River basin brought the first explorers and settlers into the region. Led by Alexander Mackenzie, the North West Company placed trading posts at strategic points along the Mackenzie system during the late eighteenth century. After merger with the Hudson's Bay Company in 1821 greater stability came to the fur-trading business and additional posts were founded. Because food was expensive to import into the area, the pioneer post factors augmented a diet of fish and game by establishing gardens for local consumption. After the middle of the nineteenth century missionaries of the Roman Catholic and Anglican Churches also settled in the Mackenzie Valley and soon extended gardening areas. A flourishing farming and gardening industry had developed by the late nineteenth century to help feed the local residents. In 1911 the missions received assistance from the Dominion Experimental Farms Service and thereafter carried on co-operative trials at Fort Smith, Fort Resolution, Fort Providence and Fort Good Hope. During the early years of this century it is estimated that there was a greater total acreage under cultivation in the Mackenzie Valley than there is at present.

Since the last Great War the increase in white population, following mining pursuits, has been paralleled by improvements in type and increases in volume of transportation. Whereas the early settlers developed gardening as a means of supplementing their food supply, the present population is able to have most of its food shipped in. The white inhabitants are engaged in various activities —administration, fur-trade, mining, and missionary work—and agriculture has been a secondary interest.

At each of the settlements in the Mackenzie Valley there are local land use problems and peculiarities. The original centres were chosen not because of their agricultural possibilities, but for the exploitation of the fur and mineral resources of the District. This is still the primary function of the settlements. Field crops and garden produce,



Mackenzie Plain east of the Mackenzie River near Fort Good Hope Photo by Eric Fry

however, are, and have been, growing throughout the Valley. In examining present land utilization and its geographic controls one has a starting point for discussions of future potentialities.

Present Agriculture

There are no farms in the Northwest Territories listed by the 1941 Census of Canada, and this information is correct in the sense that there is no farming industry comparable to that known in the settled areas of the provinces. A number of gardens, however, occupying several acres, are locally known as farms in Mackenzie District. Homesteads are not granted in the Northwest Territories, but agricultural leases may be obtained from the Government, and some are now in operation. The following table, derived from answers to a 1943 questionnaire of the Dominion Experimental Farms Service, illustrates the number and distribution of these gardens and farms in the Mackenzie Valley:

Local Centre	First Settled	White Population (1941)	Gardens* No.	Gardens* Total Acres	Farms No.	Farms Total Acres
Fort Smith	1874	241	30	50 (6)	3	50 (135)
Fort Resolution	1786	136	10	7	1	4
Snowdrift	1927	6	0	0	0	0
Yellowknife	1935	1,172	4	5 (10)	0	0 (15)
Fort Rae	1852	81	4	2	0	0
Buffalo River	1790	3	1	½	0	0
Hay River	1868	16	10	8	–	–
Fort Providence	1823	39	4	6	1	5
Trout River	....	3	1	5	0	0
Fort Liard	1800	14	6	2	0	0
Fort Simpson	1804	76	30	15 (15)	4	70 (90)
Fort Wrigley	1877	6	5	1	0	0
Fort Norman	1810	63	10	4 (6)	0	0 (12)
Norman Wells	1921	643**	2	1	0	0
Fort Good Hope	1804	14	5	4 (6)	0	0
Thunder River	....	2	2	2	0	0
Arctic Red River	1891	11	2	2 (2)	0	0
Fort McPherson	1840	17	10	1	0	0
Aklavik	1912	167	12	4 (15)	1	4 (25)
		2,709	148	119½	10	133

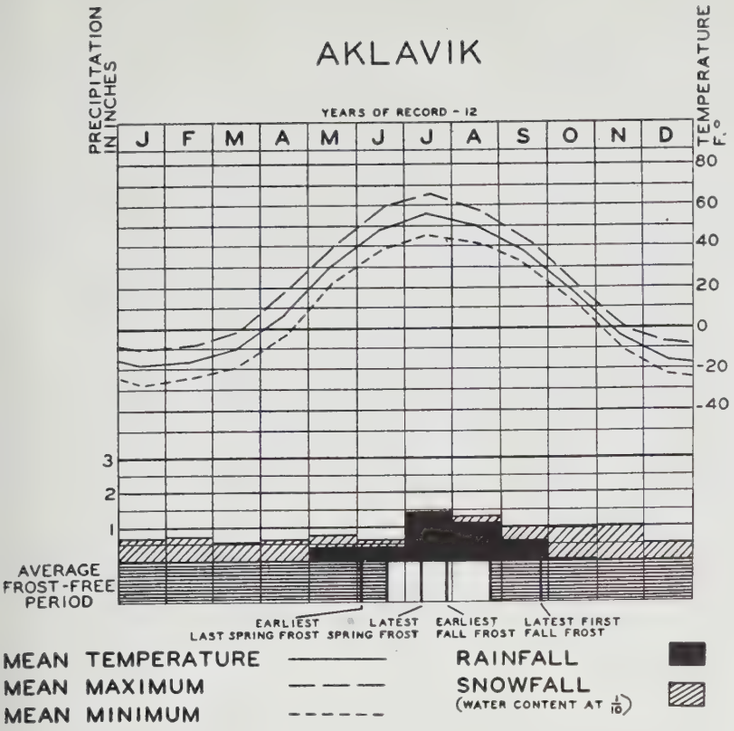
*Estimates in brackets by F. V. Hutton, 1944.

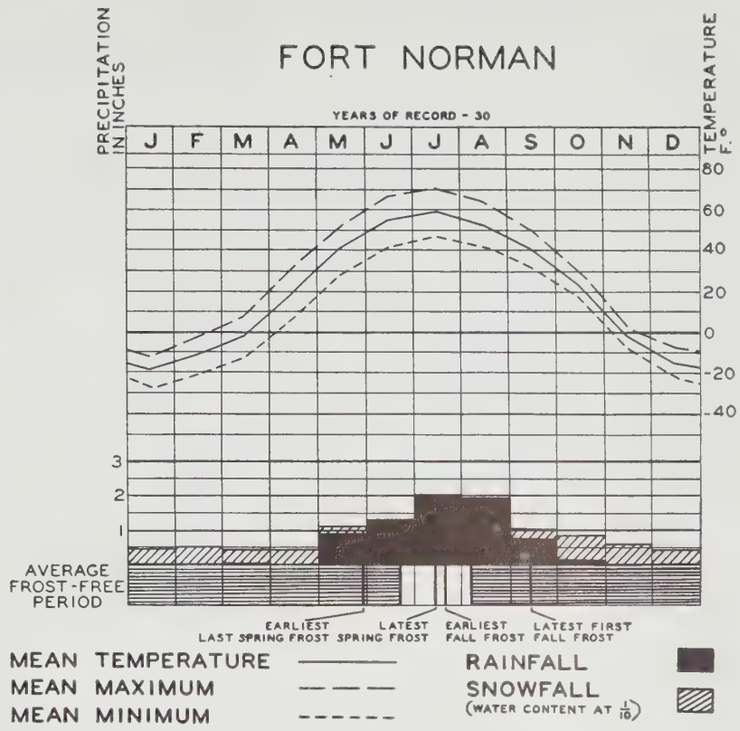
**Revised 1944 total includes Fort Norman population.

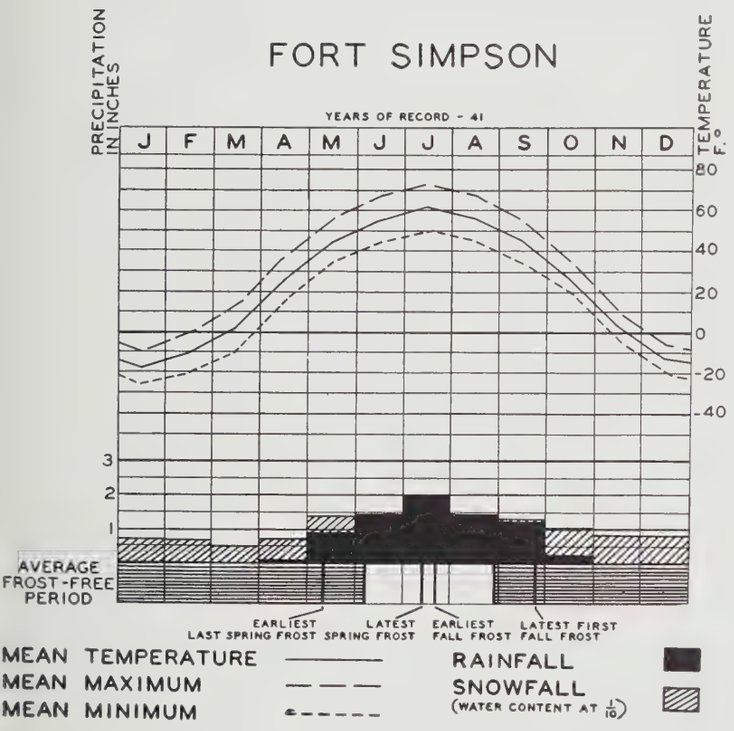
There were, in 1943, a total of 148 gardens and 10 farms in the Mackenzie Valley, with an estimated total of 252 acres of cultivated land. If allowances are made for isolated gardens which were not reported, it is probable that the present cultivated acreage of the region, with a population in 1941 of 2,113 whites and 4,322 Indians, does not exceed 300 acres. There are, however, several thousand additional acres of native grassland throughout the Mackenzie River system, scattered in large and small patches. Preliminary estimates of potential arable land indicate that there are from 2,500 to 3,500 acres near the present posts of the Mackenzie Valley. Since these areas are scattered, it is doubtful if there are any centres where a large agricultural community could develop.

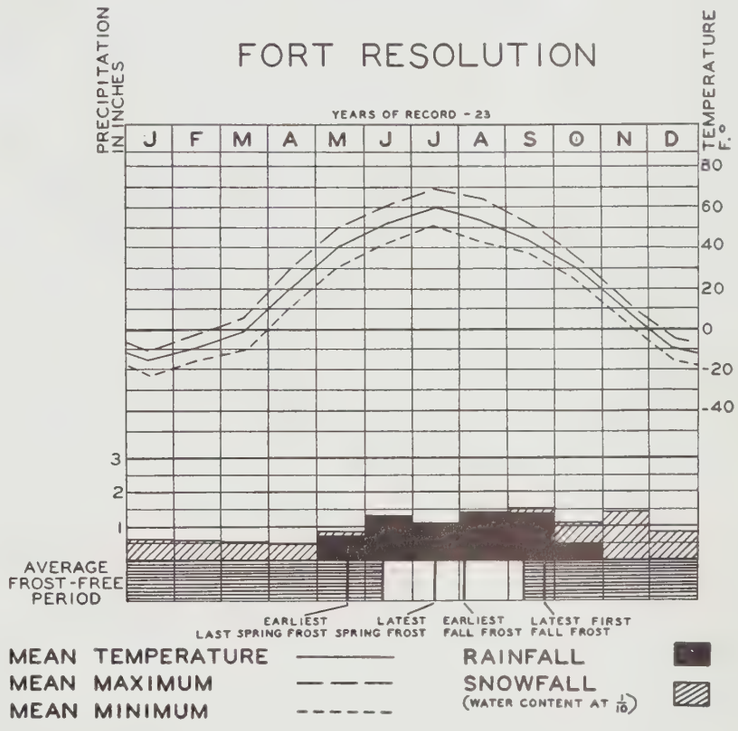
Permanent agriculture has its basis in general farming, which produces a surplus of crops for sale. In Mackenzie District these field crops have been produced only on a small scale for a scanty local population. Although cereals have been matured in a few good years as far north as Thunder River, they are grown more successfully in the southern part of the District. Experimental work at Fort Providence illustrated that barley will ripen practically every year, oats in about three out of five years and wheat only sometimes with difficulty. Usually these crops are utilized as cereal hay in years of early frost or inadequate rainfall. Forage crops have had variable success, with timothy, western rye, red top, and brome grass being most suitable.

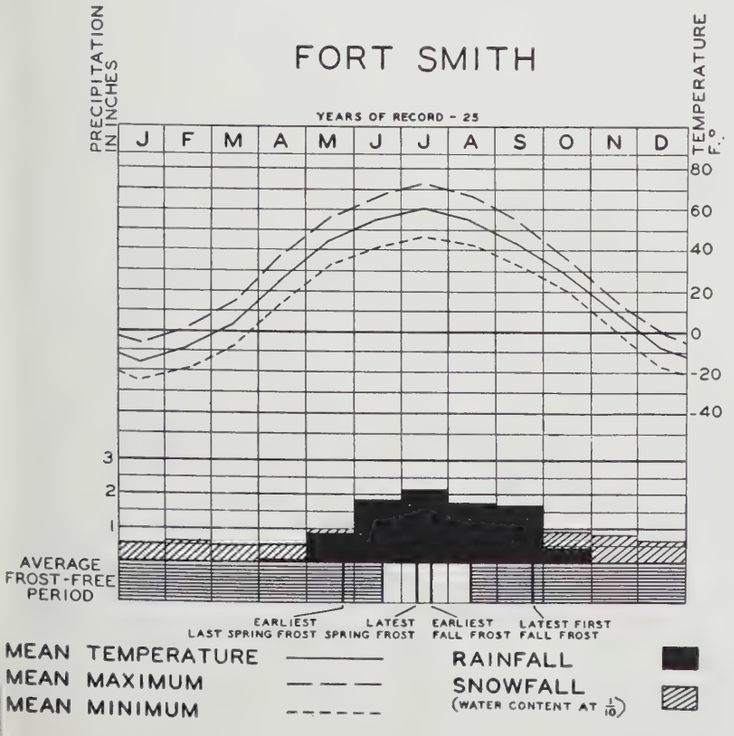
North of Fort Simpson the uncertainties of climate make the growing of field crops

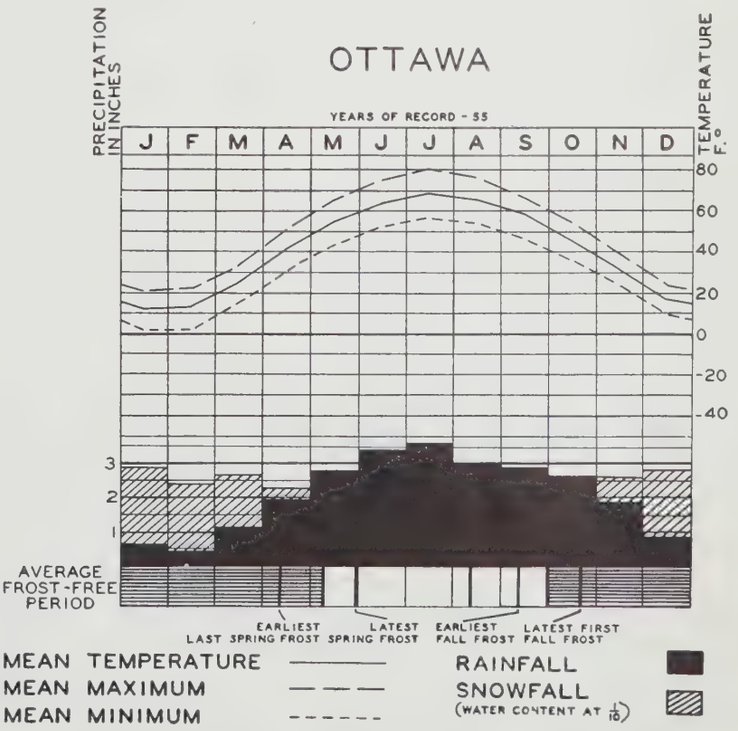












Charts by J. Lewis Robinson





Above:—Winter in Mackenzie Valley—snowfall is not deep. Scene at the Negus gold mine near Yellowknife

a rather hazardous or experimental occupation. The introduction of earlier maturing varieties and improved farming techniques could undoubtedly expand the acreage of the Mackenzie Valley farms, but at present it has been found more economical to ship in the processed products from more southerly agricultural areas.

Fort Simpson is an example of a centre where general farming and gardening have been carried on successfully since about the middle of the last century. In 1941 co-operative agricultural experiments were started there, and first results indicated that summer fallow is necessary to combat drought. The limitations of expanding general farming at the Mackenzie settlements are illustrated at Fort Simpson where much of the island is already cultivated. This acreage could probably be enlarged by another 100 acres, but local residents have not done it because of the high cost of labour for clearing and farm operations. The rolling plains on the mainland near Fort Simpson, about 100 to 200 feet above the river level, are reported to be topographically favourable, but the poor sandy soils are generally low in organic matter, and soil investigators do not consider them suitable agricultural lands. Expansion of gardening operations, however, is possible at several sites on the mainland, although the soils of the main island are probably most preferable.





Top to bottom :—
Fort Norman. Gardens in foreground
Norman Wells, 1944. Franklin Mountains to the east behind
Arctic Red River settlement from the air
Winter scene at Yellowknife town. Note the sledge tracks in the ice.

A good range of varieties of garden vegtables is grown for table use and the local market. At all settlements the following vegetables are common: lettuce, spinach, radish, cauliflower, cabbage, kale, peas, carrots, beets, turnips, green beans, and potatoes. The latter produce as high as 200 bushels per acre in good years. Although tomatoes, squash, pumpkins and gourds are hazardous crops north of Fort Smith, they produce well under glass throughout the Valley. Perennial vegetables, with the exception of rhubarb of a poor quality, are not generally grown.

Cultivated strawberries and raspberries are grown at several of the settlements, while native fruits such as wild currants, gooseberries, blueberries, raspberries, and cranberries are found all along the river system. Crabapple trees successfully bore good crops of small fruit at Fort Resolution for several decades.

The variety and colour of the flowers raised at the Mackenzie River settlements have always been a delightful surprise to summer tourists. Most of the common annual flowers are cultivated and a number of perennials are also successfully grown. Wild flowers bloom in colourful profusion throughout the Valley. Free seed for a number of new varieties of flowers, better suited to the northern climate, is being introduced in 1945 by the Experimental Farms Service.

Although there are a few acres of gardens at all of the Mackenzie centres, Yellowknife is a good example of a mining town where there is a ready market for truck garden products. Yellowknife soils vary in type and fertility and some will need clearing of moss cover. By utilizing small pockets of natural or transported soil, however, a small garden industry has developed at Yellowknife to partially meet local demands. After a reconnaissance survey it was estimated that there are about 200 acres of potential agricultural land in the vicinity. Experimental work with



Top to bottom:—
Looking east over Hay River settlement and flat south shore of Great Slave Lake.
Fort Providence and the Mackenzie River. Note the larger amount of land which was once cleared and cultivated.
Fort Simpson settlement. Mackenzie River to the left and Liard River on the right
Fort McPherson on the banks of Peel River slightly south of the Mackenzie delta
R.C.A.F. photos

various types of vegetables and field crops is being carried out during the summer of 1945 on some test plots to assist the settlement in becoming more self-sufficient.

Live stock is scarce in the Mackenzie Valley owing to the high cost of imported feed. A total of 71 horses and cattle was reported in 1944. This scarcity of animals means that fertilizers have to be imported, thus increasing farming costs. Although fresh dairy products are popular, and, when available, command a good price, many prefer canned or powdered products at a lower price. Beef is cheaper to import than to raise locally, and the permanently frozen ground is used as a natural meat refrigerator. There are only a few goats, and no sheep, in the Mackenzie Valley because of the danger from the numerous hungry sledge dogs.

The stock maintained at Fort Smith and Fort Simpson are fed locally grown cultivated hay and green grains. At Aklavik the dairy farm experiment started by the Government Medical Officer developed to a herd of 13 cattle in 1944, but the number has since been reduced. The cattle are fed on native grass during the summer, while winter forage is green oats from the farm and grass cut from sedge meadows on the delta.

Poultry, for the production of fresh eggs, is kept at several points. While the cost of feed and winter heating is not economical, the expense is considered justifiable by the owners. Most flocks are started, and are maintained, by shipments of young chicks from Alberta.

The proximity of a good agricultural district in the Peace River area to the southward is one of the chief obstacles facing any expansion in the grain and livestock industry in the Mackenzie Valley. With recent improvements in the Grimshaw-Hay River winter road, and good summer water connections, the Peace region may profitably market many of its products to the northward in the future. Development of earlier maturing varieties pushed the Canadian agricultural frontier westward and northward and may be one of the chief methods of expanding land utilization in Mackenzie District. It is probable, however, that the Valley will always be dependent upon outside areas for the bulk of its food.

Food Imports

Although the extent of agriculture carried on by the white residents of Mackenzie District may be surprising to persons unfamiliar with geographic conditions there, it still remains primarily a local industry. The accompanying table of statistics illustrating import estimates has been compiled by officers of the Experimental Farms Service from answers to questionnaires sent out in 1943. Totals do not include the large amounts shipped to men on the Canol Project at Norman Wells, since this was not normal consumption, but the final figures are undoubtedly affected to some degree by wartime activity in the Mackenzie Valley. The table emphasizes the dependence of the white population upon imported food, and shows that present land utilization could be greatly expanded to assist the local residents.

Total amounts of food imported into Mackenzie District during the year 1942-43 probably exceeded 750 tons, and this was supplemented by about 200 to 300 tons of locally produced game and cultivated food. Practically all of these imports entered the Northwest Territories by way of Edmonton, and over one-third of them were shipped to Yellowknife.

Potatoes are the only locally-raised product which is shipped in any amount. Enough potatoes are grown in the settlements along the central Mackenzie River to make these places self-sufficient in the product, with a slight exportable surplus. Imports of potatoes from "outside" are difficult to assess from the statistical table since undoubtedly many imports are actually grown within the District. For example, Aklavik is supplied by the Mackenzie River centres farther south, and Yellowknife received part of its potato supply from Fort Smith and the Great Slave Lake settlements. Similarly, many of the potatoes imported by Fort Smith are actually transshipped to Yellowknife. On the whole, Mackenzie District

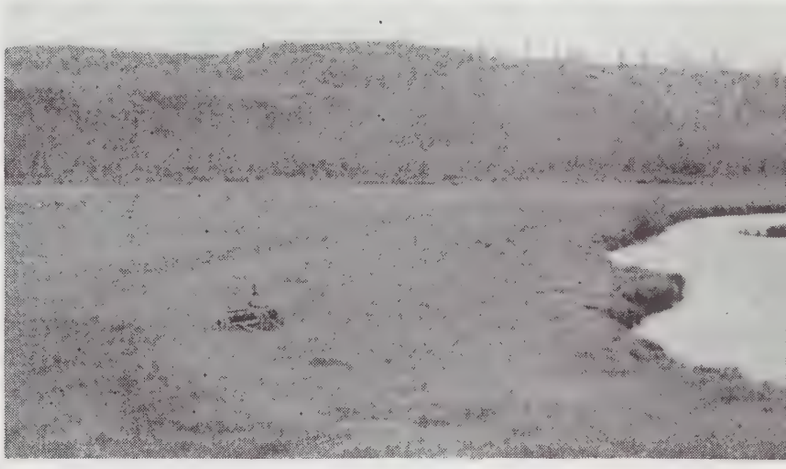
















Left, top to bottom:—

Cereal plots at the co-operative Experimental Sub-Station at Fort Simpson Photo by F. V. Hutton

Roman Catholic Mission potatoes at Fort Norman Photo by F. V. Hutton

One of the gardens at the Arctic Red River settlement Photo by C. A. Duncan

Potatoes at Fort Good Hope showing the effect of sprouting before planting. Those on the left were unsprouted. Photo by F. V. Hutton

Right, top to bottom:—

Garden carved out of the rock at Yellowknife. Note greenhouse near dwelling. Photo by M. Meikle

Crab apple trees at Roman Catholic Mission at Fort Smith. The trees had small apples on August 9th, 1944. Photo by F. V. Hutton

One of the many typical hay meadows of the Mackenzie Valley. Scene near Yellowknife. Note the bare rock ridges and scrub forest in the background. Photo by F. V. Hutton

Dr. Livingstone's cattle and dairy farm at Aklavik, 1944 Photo by F. V. Hutton



Sawmill and lumber for construction of Mackenzie River barges
Photo by H. L. Holman

probably produces about 160 tons of potatoes and imports an additional 40 to 50 tons from other parts of Canada.

Flour is one of the largest single food imports of Mackenzie District. Annual totals exceed 340 tons. No serious attempt has been made to grow wheat within the region except for local feed. At one time a flour mill at Fort Vermilion, on the Peace River, supplied much of Mackenzie District, but this was not able to remain in operation when better transportation permitted flour to be shipped in more economically from centres farther south.

The extent to which horticulture has developed is reflected in the table showing that only about 10 tons of fresh vegetables are imported. Aklavik is the only centre with a large import, owing to the retarding effect of the permanent frost zone upon root vegetables. Locally-produced vegetables are meant chiefly for summer consumption in the Mackenzie Valley, and the rest of the year's supply comes from the 80 tons of canned vegetables imported—most of which are consumed at Yellowknife.

The large settlements are the only places where there is a noticeable trade in fresh (frozen) domestic meat. Some of the settlements raise a few cattle which ultimately become beef, but on the whole they depend upon wild game for fresh meat. There is an average annual consumption of 350 reindeer carcasses in the Aklavik area from the nearby Government herds. This amount does not appear in the accompanying table of meat imports, but as a source of food the reindeer herds may be an important factor influencing future settlement in this area. Game supplies have to be supplemented by canned and preserved meats which are imported into all of the settlements to a total of about 54 tons.

Fresh eggs are obtained at only a few centres and in limited quantities. About 3,000 dozen eggs are locally produced—half of these at Fort Smith, and about 50,000 dozen are imported.

The dairying industry has received very little incentive. Despite the psychological value of having fresh milk, present residents have not found dairying practical owing to the cost of imported feed, and the necessary long winter feeding. Over 2,000 cases of canned milk are imported annually by the Mackenzie Valley residents. An additional importation of 56,000 pounds of butter illustrates the possibilities of a grazing industry which could raise its own feed and prove economical enough to compete with cheaply-imported products.

Forest Utilization

There is no lumbering industry in Mackenzie District similar to that in the provinces, but the area is fairly well forested and supplies lumber for local needs. As previously mentioned much of the region contains stunted timber of no present economic value as lumber, but merchantable stands are known along the Slave and Liard Rivers.

Proper land utilization must maintain

some of the good soil areas as forest reserves, and this resource must be protected from the ravages of fire. Forest fires can destroy large areas of hunting and trapping grounds thereby impairing the livelihood of the Indians. Forest conservation is thus concerned not only with saving forests for lumber, but also in having forests to protect game, fish and fur. For the latter, timber does not have to be merchantable, for even brush and scrub can be a protection. Forest fires in Mackenzie District have become more numerous and of larger proportion in recent years and have often hindered air transportation. This condition has resulted in the establishment of a forest fire protection system in the District in 1945.

No estimates of the amount of reserve timber are available, but it is known that present cutting rates are having little effect upon the total forest reproduction. The following table shows the annual totals of timber cut in Mackenzie District for the past 10 years. Most of it has been cut in the Slave River area.

Year	Board Feet	Linear Feet	Cords
1933-34	201,884	41,052	85
1934-35	341,644	23,923	5,589
1935-36	289,320	50,732	5,788
1936-37	364,253	66,940	5,683
1937-38	599,804	57,372	13,277
1938-39	946,743	38,108	12,167
1939-40	763,756	45,762	11,025
1940-41	1,012,826	82,079	9,760
1941-42	1,748,649	29,660	17,656
1942-43	1,760,863	27,230	18,594
1943-44	963,024	252,856	11,184

The amount of locally grown timber being cut has been gradually increasing. The mining activity at Yellowknife following 1937 gave a larger demand, and the increase continued when wartime activities reached the District. The preceding table does not include the timber cut for the Canol Project which totalled 813,000 board feet and 9,000 linear feet in 1942-43, and rose to 4,835,000 board feet, 52,675 linear feet, and 16,000 telephone poles in 1943-44. The forest resources of Mackenzie District played an important part in this building project, and will be available for any future utilization.

Government Assistance

In order to assess the present extent of land utilization in Mackenzie District, and have facts available for future planning, various Government departments have assisted by sending scientific specialists into the field during recent years. In the field of northern agriculture an Interdepartmental Committee was formed in February, 1943, with representatives from the Departments of Agriculture and Mines and Resources, under the Chairmanship of Dr. E. S. Archibald, Director of Experimental Farms Service.

One of the results of the formation of the Committee has been field investigations on agricultural possibilities. These were carried out by Dr. A. Leahey, and F. V. Hutton of the Dominion Experimental Farms Service. Leahey travelled along the Alaska Highway in northern British Columbia and the Yukon in 1943, and in southern Mackenzie District in 1944. Hutton visited the settlements along all the Mackenzie River during the summer of 1944. The Lands, Parks and Forests



Logs cut for local use, Slave River delta.
Photo by H. L. Holman

Branch also sent H. L. Holman of the Dominion Forest Service into the Mackenzie Valley in 1944 to report on a suitable forest fire protection system for the southern part of the region. He will return to the area in 1945 to assist in the organization of this system.

Further soil investigations and gardening assistance will be undertaken during the summer of 1945 by personnel of the Experimental Farms Service. Particular attention will be given to the town of Yellowknife so that a post-war mining population may have a greater local food supply. Soil surveys will also be made in the potential agricultural area along Salt River. In addition, the agricultural experts will investigate possible sites for Experimental Sub-Stations which can assist and direct the future of agriculture in Mackenzie District.

As a result of Dr. Leahey's soil survey of the Liard Valley and Mackenzie Valley south of Fort Simpson, it is known that large tracts of unsettled land in the middle Liard Valley have agricultural possibilities. With regard to general agriculture in Mackenzie District, he believes that there are several areas where all the physical requirements for successful farming are present, but any ultimate development or expansion is closely linked with the matter of markets.

The most intensive use of the land at present is for gardening, and Hutton's horticultural survey investigated the possibility of increasing the production of fresh vegetables, meat, eggs, and milk so that a post-war influx of settlers would have lower costs of living and improved health and well-being. Through personal contact with the gardeners of the Mackenzie Valley, expert advice on type and quantities of fertilizers was furnished, and the use of earlier maturing varieties suggested. Local residents should now be able to produce more from their present plots and know the possibilities of extending them. Much of the gardening has been haphazard, but, in 1945, the Experimental Farms Service is sending seeds and fertilizer free of charge to a select list of 32 co-operators in the Mackenzie Valley, and, in addition, will again give personal assistance and advice. The future should witness an improvement in the gardening industry.

Conclusion

On the whole, the Mackenzie Valley has certain favourable geographic conditions which will support limited general farming, an expanded horticultural industry, and adequate forest reserves. The future of development will be closely linked with progress in the utilization of earlier maturing grains and vegetables. The current soil surveys and other field investigations are important in establishing basic facts concerning land use possibilities of the region. These correlated facts will play their part in the general plan of study and use of the natural resources of the Canadian Northwest.

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This article is based chiefly upon unpublished information contained in the files of the Bureau of Northwest Territories and Yukon Affairs. Supplementary information may be obtained from titles provided.

PRODUCTION AND IMPORTATION OF FOOD IN THE MACKENZIE RIVER BASIN, 1943*

Settlement	Potatoes Produced Locally	Potatoes Imported	Flour Imported	Fresh Vegetables Imported	Canned Vegetables Imported	Fresh Domestic Meat Imported	Canned Meat Imported	Eggs Produced Locally	Eggs Imported	Milk Imported	Butter Imported
	lb.	lb.	tons	lb.	cases	lb.	cases	doz.	doz.	cases	lb.
Aklavik.....	2,000	30,000	75	10,000	400	Nil	250	100	12,000	300	6,000
Fort McPherson	1,000	5,000	25	Nil	40	Nil	40	Nil	600	40	2,000
Arctic Red River	2,000	2,000	7	Nil	10	Nil	25	Nil	600	30	500
Fort Good Hope	12,000	2,000	16	Nil	35	Nil	250	Nil	3,300	85	1,600
Fort Norman...	22,000	Nil	20	Nil	15	Nil	250	50	3,000	160	3,600
Fort Wrigley...	750	Nil	5	100	5	Nil	15	Nil	210	12	400
Fort Simpson...	100,000	Nil	35	2,000	85	1,200	250	800	4,500	145	3,800
Trout River....	30,000	Nil	3	Nil	A few	Nil	12	Nil	150	7	400
Fort Providence	40,000	Nil	35	Nil	30	Nil	50	150	1,500	40	2,000
Hay River.....	12,000	Nil	10	500	50	2,000	100	Nil	1,500	80	2,000
Buffalo River...	5,500	Nil	–	–	–	–	–	Nil	–	–	–
Fort Rae.....	1,200	2,000	15	1,000	63	1,000	165	Nil	1,500	50	2,000
Yellowknife....	Nil	100,000	75	3,750	2,500	80,000	500	600	15,000	1,000	25,000
Snowdrift.....	Nil	1,000	5	400	25	Nil	20	Nil	360	15	1,500
Fort Resolution.**	27,000	Nil	–	–	–	–	–	150	–	–	–
Fort Smith.....	50,000	25,000	8	1,000	42	12,000	250	1,200	4,500	100	3,000
Fort Liard.....	10,000	Nil	7	Nil	15	Nil	75	Nil	750	55	1,500
Totals***..	315,450	187,000	341	18,750	3,315	96,200	2,252	3,050	49,470	2,119	55,450
Totals in Tons	157.7	83.5	341.0	9.4	79.6	48.1	54.0	2.3	37.1	50.8	27.7
Total Imports	731.2 tons										

*Compiled at the Experimental Farms Service, Department of Agriculture, Ottawa.

**Incomplete.

***All figures are usually estimates.



Forest growth at one of the many lakes near Fort Smith

Photo by H. L. Holman



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Water Transportation in the Canadian Northwest



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DEPARTMENT OF MINES AND RESOURCES
Ottawa, Canada

MACKENZIE -- YUKON DRAINAGE SYSTEMS

NORTHWESTERN CANADA

SCALE IN MILES
0 50 100

145 140 135 130 125 120 115 110 105

70 65 60

AMUNDSEN GULF
C. Bathurst
Franklin Bay
C. Parry
Darnley Bay
Pearce Pt.
VICTORIA ISLAND
Read Is.
C. Krusenstern
CORONATION GULF
Coppermine
Burnside Harbour
Hood R.
Burnside River
Western River
Back River
Mackenzie Bay
Herschel
Tuktuk
Eskimo Lakes
Anderson R.
Horton River
Rae R.
Dease R.
Coppermine River
Reindeer Station
Aklavik
Old Crow
Porcupine River
RICHARDSON RANGE
Rat R.
Ft. McPherson
Arctic Red River
Arctic Red R.
MACKENZIE RIVER
MACKENZIE DISTRICT
Colville Lake
Lac des Bois
Hare
Ft. Good Hope
Rampart R.
Indian R.
FRANKLIN MTS.
Carcajou R.
Norman Wells
Gt. Bear R.
GREAT BEAR LAKE
Port Radium
Ft. Franklin
Hottah Lake
Norman
Keele River
MTS.
Redstone River
Root R.
Wrigley
Lac la Martre
Ft. Rae
Snare R.
Lockhart R.
Ft. Reliance
Yellowknife
Snowdrift
Horn R.
HORN MTS
Ft. Simpson
South Nahanni R.
Mills L.
Ft. Providence
GREAT SLAVE LAKE
Rocher River
Ft. Resolution
Slave R.
Talston R.
Liard River
Trout R.
Trout L.
Tathlina L.
Hay River
Buffalo R.
Ft. Liard
Beaver River
Watson Lake
Frances River
Frances Lake
Coal River
Highland
PELLY MTS.
Big Salmon R.
Lake Laberge
Teslin R.
Teslin
Whitehorse
Champagne
Kluane Lake
Kluane
Burwash Landing
Ross River
Pelly River
Macmillan River
Carmacks
Lewes River
Ft. Selkirk
White River
Donjek River
Alsek River
Alsek MTS.
Skagway
Tagish Lake
Atlin Lake
Atlin
Robinson
Carcross
Stewart River
Mayo
Keno Hill
Stewart River
Klondike River
DAWSON
Fortymile
Peel River
Yukon River
YUKON TERRITORY
OGILVIE RANGE
MACKENZIE MOUNTAINS
STELIAS
YUKON
BRITISH COLUMBIA
CAMERON HILLS
ALBERTA
SASK

Water Transportation in the Canadian Northwest*

by J. L. ROBINSON**

TRANSPORTATION is one of the keys to the future development of the Canadian Northwest. The exciting optimism of the present air age regarding northern air routes across the "top of the world" is apt to make one overlook the fact that northern Canada has two fine navigable water systems, the Mackenzie and Yukon, which have been carrying freight and supplies and opening up the country for over a century. Although new air and land routes will undoubtedly do much to facilitate development in Canada's Northwest, the bulk of heavy imports has always been most economically carried by water transport when available.

Both the Mackenzie and Yukon Rivers are broad and long and rank with the ten greatest river systems in the world. The series of rivers and lakes which makes up the Mackenzie waterway has a total length of 2,500 miles from the headwaters of the Finlay River in the Rocky Mountains (a length almost equal to the width of Canada), and drains a basin with an area of about 700,000 square miles (one-quarter of the mainland area of Canada). In North America the Mackenzie River system is exceeded in length and drainage area only by the Mississippi-Missouri system of central United States. Yukon River is 1,979 miles long from the headwaters of Nisutlin River in the Mackenzie Mountains (714 miles in Canada and 1,265 miles in Alaska), and has a drainage basin of 320,000 square miles (127,000 square miles in Canada).

According to the map, the routes appear to offer broad water highways to the Arctic Ocean or Bering Sea which belie the actual problems of navigation to be found. The fact that passengers can travel by comfortable steamer, with only one break, the entire 1,700 miles from Waterways to the Arctic Ocean has probably contributed to many of the misconceptions concerning the character of the rivers.

For more than 150 years the Mackenzie River and its tributaries have been carrying the traffic of the fur trade, and also, in recent years, that associated with mining and other developments in Mackenzie District. In the Yukon the story of transportation is inevitably linked with the historic Klondike strike and the gold-mining industry of the Territory. Despite the general familiarity of Canadians with these broad facts, there still remain many hazy ideas as to the actual character and possible utilization of our northern rivers. A careful analysis of certain geographic factors can help in forming a background to an understanding of the role of water transportation in this area.

Historical Background

Canadian settlement westward was led by explorer-traders who, following the major river systems, pushed farther and farther into the Northwest to tap the source of furs for their respective companies. In 1778 Peter Pond found the famous La Loche (Methye) Portage, which extended from the headwaters of Churchill River to Clearwater River, one of the sources of Mackenzie River. In 1789 Alexander Mackenzie made his historic journey northward from Fort Chipewyan on Lake Athabaska, and explored the mighty river now bearing his name to its mouth on the Arctic Coast. In the following decades fur-trading posts, serviced by birch-bark-canoe brigades, were established northward along the Mackenzie and its tributaries.

Around 1826 canoes were generally replaced by larger York boats, which carried greater amounts of freight and were better suited to transport on the larger rivers. The distinctive York boat was a shallow-draft vessel of 40-foot length, 10-foot beam, and shaped like a whale-boat with sharply

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**Photos by the author unless otherwise credited.

angled stern and bow. It carried both oars and a square sail, but was usually "tracked" upstream, the crew walking along the shore and pulling a line attached to the boat. During the greater part of the nineteenth century York boats carried most of the freight to the Mackenzie Valley from York Factory on Hudson Bay via the Hayes, Saskatchewan, Churchill and Clearwater Rivers to the regional distribution centre at Fort Chipewyan. [1] From there they drifted northward to the Mackenzie River and downstream as far as Fort McPherson, the Hudson's Bay Company's most northerly post at that time.

The introduction of steam-power changed water routes in the Northwest. The first river-steamer reached Edmonton in 1875, following the North Saskatchewan River, and in 1886 a wagon-road was built northward from Edmonton to Athabaska Landing on the Athabaska River. [2] The 12-mile La Loche Portage, over which generations of voyageurs had toiled, then shared importance with the Athabaska River route, but both it and the Saskatchewan River steamer route fell into disuse after 1891 when the railroad was extended from Calgary to Edmonton.

About the same time the type of river transportation in the Mackenzie Valley underwent a radical change. In 1884 the steamer *Grahame* began to operate from McMurray, at the junction of the Clearwater and Athabaska Rivers, to Smith's Landing (now Fort Fitzgerald). [3] Northward-bound freight was then unloaded and hauled through the bush around the 16-mile rapids in Slave River. In 1885-86 Captain Smith built the steamer *Wrigley* at the north end of the portage (now Fort Smith), and in the next year it began service northward to Fort McPherson. In 1887 the first stern-wheeler started to carry freight on Athabaska River from Athabaska Landing to Grand Rapids, and from there river-scows (as many as 100 in a single year) floated downstream to McMurray and Fort Chipewyan, where they were broken up for lumber.

Modes of transportation remained generally unchanged on the Mackenzie system for many years thereafter. In 1903 the steamer *Mackenzie River* became the first stern-wheeler to operate on the lower Mackenzie, and it was well able to carry all the supplies needed for northern posts.

A new period began in 1912, when the railroad was extended from Edmonton to Athabaska Landing, superseding the wagon-road. The year 1914 was the last for the Athabaska scow-brigades, for in 1915 the railroad was continued to the town of Peace River. Trade then started to flow via the Peace River instead of the Athabaska. The former is a slightly larger river, and has only one break in navigation — Vermilion Chutes, a 14-foot fall about 300 miles below the town of Peace River. Stern-wheeled steamers began plying the Peace above and below the Chutes, while a 4½-mile wagon road carried freight between the steamers. [1]

Peace River was the gateway to Mackenzie Valley for only a few years. The railroad from Edmonton again pushed northward into "bush country", and in 1921 reached Clearwater River about 8 miles east of its junction with the Athabaska River. [4] In 1925 it was extended to the present site of Waterways, 3 miles from McMurray. After this last extension the modern period of development began in the





inage divide in e Mackenzie untains between kon and Macken- tributaries
R.C.A.F. photo

Northwest Territories, with freight moving by rail to the northern terminal at Waterways and thence by river-steamers to northern settlements.

Water transportation on Yukon River extended upstream from Bering Sea and the Alaskan Coast. Although the early explorers used canoes and hand-made lumber boats to travel downstream, the first steamers worked their way inland from St. Michael near the delta mouth of Yukon River on Bering Sea. The small stern-wheeler *Wilder* was taken north in 1866, and is believed to have been the first steamer to operate on the river. [5] Yukon Territory was entered in 1871, when the steamer *St. Michael* pushed upstream as far as Fort Selkirk.

As traffic and freight increased, the trading companies using the Yukon added newer and larger boats, but in 1897 it was reported that only two ocean-going vessels discharged freight and passengers at St. Michael and that five river steamers were serving the needs of Dawson and vicinity. [6]

River traffic boomed when gold was discovered on the Klondike. In 1898 twenty vessels carrying gold-seekers navigated Yukon River as far as Dawson, and additional boats were constructed or assembled during the summer at Alaskan ports. [7] Frantically hurrying gold-seekers, however, demanded a shorter route to the Yukon placer wealth instead of the long trip through the Aleutians, Bering Sea and up the Yukon River. In August, 1898, construction was started on the White Pass and Yukon Railway from the port of Skagway, Alaska, to Whitehorse, Yukon, following a route over which prospectors had climbed the preceding year.

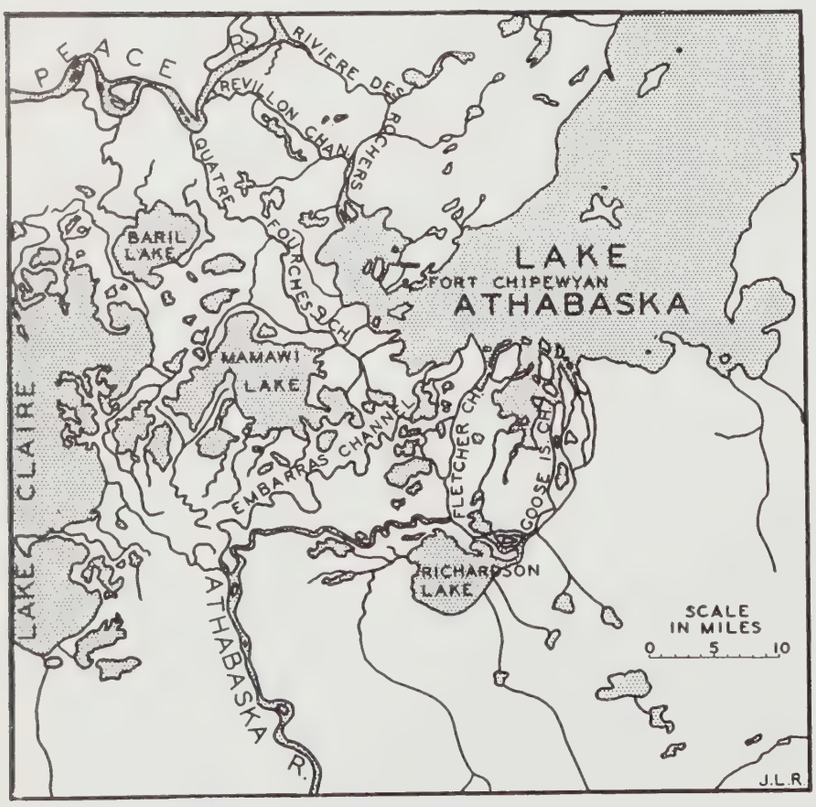
The railroad crossed the steep mountains and reached Lake Bennett in 1899, where small steamboats and other boats of all sizes and descriptions were constructed to carry freight and passengers to Carcross at the north end of Lake Bennett. Many of the boats continued down Lewes River and shot Miles Cayon and the White Horse Rapids south of Whitehorse. In August, 1900, the railroad was completed to Whitehorse and steamer service was established from Whitehorse to Dawson. In the following years most of the traffic entered Yukon Territory via this shorter and faster passage. The White Pass and Yukon Route, including one of its subsidiaries, British Yukon Navigation Company, built up an efficient transportation service, which became virtually a monopoly to the mouth of the Yukon River.

Left:—White Pass and Yukon Railroad beside Lake Bennett
W.P.&Y.R. photo

After completion of the Alaska Railway from Seward to Fairbanks in 1922, the British Yukon Navigation Company relinquished its business on the lower Yukon River to a United States Government-owned line of river-boats. In turn, the latter agreed not to operate vessels up-river from Tanana, Alaska, into Yukon Territory. Since that time the Canadian company has maintained large river-steamers, barges, and gas-boats on the Lewes, Yukon and Stewart Rivers, carrying the freight and passengers of the Territory.*

Mackenzie River Waterway

The great basin of the Mackenzie River is surrounded by a variety of topographic features. (8) On the south the level plateau country north of Edmonton is the only divide between the waters of the Saskatchewan, which flow eastward to reach Hudson Bay, and those of the Athabaska River, which ultimately empty northward into the Arctic Ocean. To the southwest the numerous headwater streams of the Athabaska and Peace Rivers have their sources within the high ranges of the Rockies. The barren jagged peaks of the Mackenzie Mountains form the divide between the central west tributaries of Mackenzie River and the eastern headwaters of Yukon River. Tributaries are not so well defined on the eastern side of the Mackenzie Basin, where waters drain haphazardly from the rocky hills of the Canadian Shield. The whole region lies within an area of low annual precipitation (10 to 14 inches), so that low water-levels should be expected, and do occur, during the autumn.**



Climatic conditions limit the period of navigation on the Mackenzie waterway to about four months. Owing to the great latitudinal extent of the river system, there is a difference of about three weeks between the time when southern tributaries are usually ice-free in early May and when the Mackenzie delta channels break up at the end of May. Long periods of record at Simpson, Norman and Good Hope show that the average date of break-up in the Mackenzie at these places is May 15, with May 8 being the earliest date recorded and May 30 the latest.

The large bodies of lake water are slower in breaking up in the spring, and are, therefore, the delaying links in the chain of navigation. The ice does not break away from the shores of Great Slave Lake until early in June, and a period of about two weeks follows during which winds move the ice around in the lake. Clearing is rapid or slow depending on whether winds break up the floes and blow them towards the outlet or, more likely, the prevailing westerly or northerly winds hold the ice against the south shore until much of it melts. Ice remains longer in the eastern part of Great Slave Lake, generally not breaking up until late June, owing to the large number of islands there.

The streams tributary to the Mackenzie River are free of ice first, and in breaking up loosen the ice of the main river. Of prime importance to early navigation is the fact that the Liard River thaw comes in late April or early May, with the middle Mackenzie breaking up about ten days later and making a route to the northern posts available about six weeks before Great Slave Lake is open for through traffic. The northern tributaries, Arctic Red and Peel,

*Historical information supplied by C. J. Rogers, President of the White Pass and Yukon Route.
**For precipitation graphs of Mackenzie District, see the *Canadian Geographical Journal*, July, 1945, p. 39.



Aerial view of Athabaska delta
R.C.A.F. photo

usually break up during the third week of May, and the lower Mackenzie follows about a week later.

In the autumn, ice starts to form along the shores late in September, and by mid-October drift-ice appears in the lower river. [9] Since the river-boats are usually wintered near Fort Smith, the last south-bound boat tries to leave Aklavik early in September to be back at the southern terminal by early October. In years of exceptionally heavy traffic, as in 1942, some of the boats freeze in on the lower river through risking additional late trips.

Final freeze-up comes in late October in the delta area, middle November on the upper Mackenzie River and late November on the southern tributaries. Great Slave Lake freezes over during December, but is usually not safe for tractor traffic until January. It has been suggested that the frozen Mackenzie route would make an excellent winter road, but the difficulty lies in the fact that the river usually freezes over "rough". Freeze-up comes when the ice-floes gradually get thicker and larger and finally join together. Only if a sudden drop in temperature freezes the river before the blocks join will a section freeze smoothly and make an excellent road for dog-team travel.

The Mackenzie waterway consists of a series of lakes and rivers. [10] From McMurray onwards the Athabaska is a smooth and broad river, with an average width of 1,800 feet, an average current of 3 miles per hour, and a grade of about 8 inches to the mile. The river has cut its way into the plateau surface so that its banks are about 300 feet high at McMurray; they decrease northward, and are at water level where the Athabaska delta joins Lake Athabaska. Navigation through Athabaska delta necessitates careful piloting, owing to the continual silting and shifting of several branching channels. (See map p. 240.)

The Athabaska delta area is at present one of the most serious impediments to northern water transportation and an example of how geographic conditions have determined the type of transport craft used on the waterway. Although Athabaska River has a generally deep channel, boats must be designed to operate in depths of as little as 3 feet in the delta, where even lower water often occurs in the autumn. Shallow-draft,



Left:—River-front and wharves at Fort Smith

Right:—One of the wide meanders in Slave River. Note how the trees within the bend mark former channels.

flat-bottomed river-boats of the present type are generally able to pass this bottle-neck, but even they may be held up for several days in spring awaiting higher water, and sometimes have been unable to return to Waterways in the autumn when levels drop again. The Dominion Government was constructing a dredge in this area in 1945 to try to keep a channel open to combat the natural geologic process of delta-formation.

Lake Athabaska, the southernmost of the three great lakes in the Mackenzie Basin, is about 200 miles long, with a greatest north-south width of 35 miles. Water in the eastern end is clear and deep, but the western section is shallow and turbid as a result of continual silting. River-craft must navigate far into the lake to skirt these shallows, risking another danger—the possibility of rough water when the wind is from the east or north. The flat-bottomed barges and river-steamers are vulnerable to such storms, and experience has taught captains to wait at the mouth of the Athabaska for good weather.

There are several channels draining the western end of Lake Athabaska, but the main one is Rivière des Rochers, which meanders northward for 30 miles before joining Peace River. Rochers River has a small rapid about 20 miles north of the lake during periods of low water on the Peace, but this normally causes no difficulty. North of the junction of the Rochers and Peace the combined waters are known as Slave River. From Peace River to the head of the rapids at Fort Fitzgerald the Slave is a broad deep stream from 1,800 to 3,000 feet wide with no navigation hazards.

Within the 16-mile stretch from Fort Fitzgerald to Fort Smith, the Slave is broken by a series of dangerous rapids which drop a total of 125 feet. Since supplies were





first shipped into Mackenzie District, they have always been portaged around these rapids. With provincial and Dominion help the ox-cart trail on the west side of the river was developed into a road suitable for motor traffic, and in 1931 private interests undertook maintenance of the road in return for a franchise on transportation of passengers and freight. A second portage road, generally parallelling the first, was constructed by another company in 1934, and has been owned by the Dominion Government since 1944. Both roads were improved, maintained, and linked by short connecting roads by the United States Army Engineering Corps during 1942-44.

Fort Smith is located about a mile north of the Territorial boundary (60 degrees latitude). [11] Its present importance is derived from its position at the head of navigation for steamers and river-craft operating on the lower Mackenzie River system. From Fort Smith water transportation efficiently moves most of the freight of Mackenzie District—not without difficulties and hazards—as far as the Arctic Coast, 1,400 miles to the north, and across Great Slave Lake to the large mining settlement at Yellowknife.

Below the rapids, Slave River follows an easy meandering course to its delta at Great Slave Lake. Minimum channel depths of 5 feet are found, but the river is generally much deeper. The winding river has a length of 200 miles for an air-line distance of 100 miles, and at "le grand détour" follows a curve of 16 miles to advance a half-mile. Because the current of the Slave is faster than that of the Athabaska, and carries less sediment, Slave delta is not being built out rapidly. The several channels are fairly well defined, but are usually buoyed each year by the Department of Transport.



eft:—Rapids of the Drowned in Slave River at Fort Smith

Right:—The portage oad between Fort Fitzgerald and Fort Smith

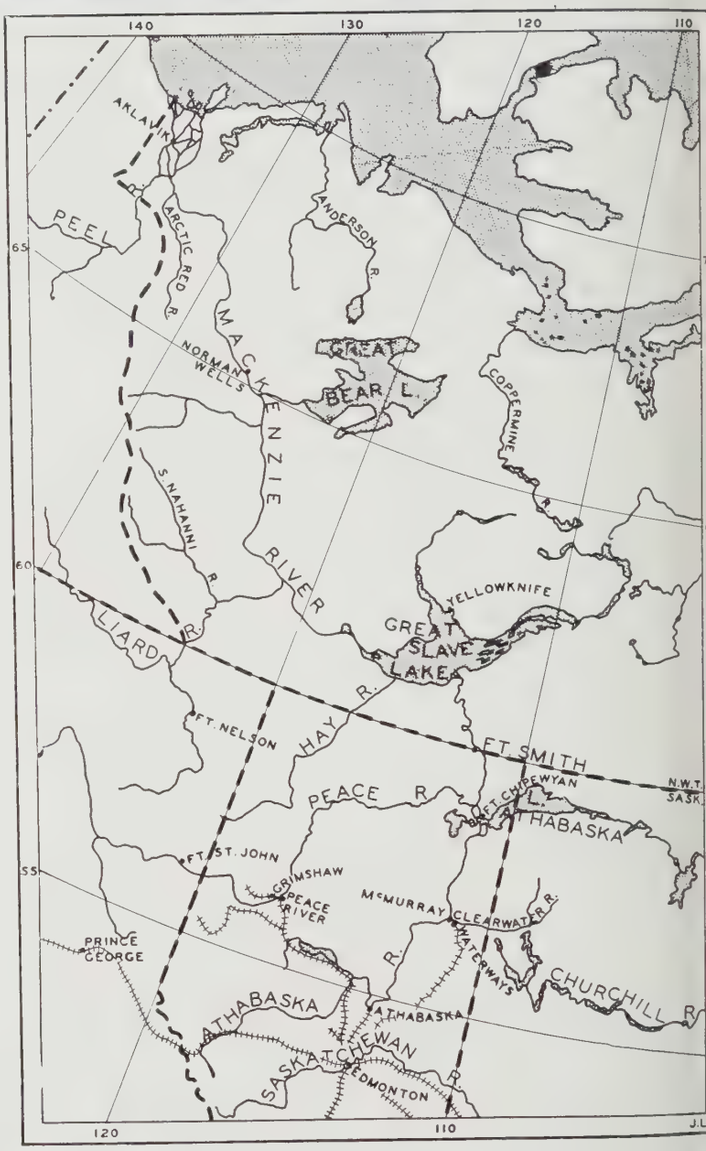


Looking sout over the mar branching cha nels of Slav River delta.

Great Slave Lake is the fifth largest in North America, being greater than either Lake Erie or Lake Ontario. (12) The eastern arm of the lake is very deep in places (1,000 and 1,440 feet have been recorded), and is a scenic area of numerous islands, peninsulas, and channels, coloured by steep red cliffs and deep blue water. Depths of 100 feet are average in the north arm of Great Slave Lake, but water becomes shallow at the northern end, and lake-boats deposit their cargoes several miles from Fort Rae. The central part of the lake averages 200 to 500 feet in depth, but the western section is fairly shallow throughout, especially along the south shore.* At Fort Resolution it was necessary to build a long wharf into the lake to enable supply boats to unload their cargoes, but at Hay River settlement the current of Hay River has maintained about an 8-foot channel, deep enough for the shallow-draft steamers.

One of the popular misconceptions has been that these great lakes in the Mackenzie Basin offer a peaceful respite from the hazards of river navigation, whereas actually they present one of the chief problems. (13) Although the upper Mackenzie and Slave Rivers are free of ice about mid-May, traffic cannot move until mid or late June, when the ice in the lake finally breaks up. In addition to delaying the opening of navigation, the lake can have rough water

*Charts of the lake and river are prepared by the Hydrographic and Map Service of the Department of Mines and Resources.





Looking north at the Ramparts in Mackenzie River.



ead of Macken- River draining eat Slave Lake. ift-ice is leav- the lake in d-June.

during the summer, which forces steamers to tie up for several days in Slave delta awaiting calm water to cross the 110-mile stretch to the head of Mackenzie River.

Mackenzie River is fairly wide at the western end of Great Slave Lake, but is split into several channels by numerous low islands. The deepest water is found south of Big Island, where a shelter at Wrigley Harbour is often used by the river-boats. During bad weather, barges are left here while the boats shuttle across the lake to pick up other barges left on the south side.

The main river narrows near Fort Providence, about 45 miles from Slave Lake, and fast water about 6 miles east of the settlement calls for expert piloting. This section is a more serious problem on the upstream journey, when the frequent inability of boats to push all their barges against the current necessitates their making several trips through the narrows to take the barges singly.

Mills Lake is a broadening of the Mackenzie west of Fort Providence, but farther westward the river again narrows to about a mile in width. [14] A stretch of 70 miles east of Fort Simpson has fast water in which the most serious hazard is Green Island Rapids, 12 miles from Fort Simpson. The rapids, which have plagued river captains for many years, are the result of glacial boulders in the channel. Each winter and spring the ice moves these boulders so that every year a new channel must be found and buoyed on the first northward trip. This section was charted by the Dominion Hydrographic Service in 1945, assisted by officers of the Department of Public Works, and a new 7-foot channel was found in midstream.

At Fort Simpson the Liard, a large river in itself, joins the Mackenzie from the southwest. Its load of silt is added to those of the smaller northward Mackenzie tributaries which drain the mountains flanking the lowland valley north of Camsell Bend. As a result, numerous long low islands, shifting sand-bars and glacial boulders necessitate careful navigation from the experienced river-pilots and captains. At Berry Island, for example, where the channel follows a narrowing between the island and the east bank, the current is not fast and boulders on the bottom cannot be detected. Boats usually drift through this section slowly, but, despite caution, several barges have been wrecked or punctured.

The cold clear water of Bear River empties into the Mackenzie from the east at Fort Norman, and at Norman Wells the Mackenzie is a mighty river 4 miles wide. South of Fort Good Hope two more serious obstructions impede through-transportation.



One of the many scenic branching channels in Mackenzie delta near Aklavik

At Sans Sault Rapids the river tumbles over a rock reef which is quite dangerous in low-water periods, but covered during high water. The Ramparts is a picturesque narrowing where the river passes through perpendicular limestone cliffs 100 to 150 feet high. There is a drop of 20 feet in a distance of about 7 miles, but the rapids are fairly deep, and the hazard lies in the 6 to 7 miles per hour average current.

The most serious navigation difficulty of the Sans Sault and Ramparts rapids is met on the upstream trip. If the water is high (as in early summer), Sans Sault rapids are covered, but the current in the Ramparts may be too strong for the river-boats, and they often have to pull themselves through by cables from the deck attached to shore. In the autumn, when water is low, the Ramparts can be navigated without help, but the Sans Sault Rapids become almost impassable.

North of Fort Good Hope there are numerous shifting sandbars, and the channel meanders back and forth across the slowly-moving river. At Point Separation the Peel River joins the main waterway and both rivers split up into a great number of streams and channels which wind their tortuous ways through a low lake-dotted delta.

The Mackenzie delta is over 100 miles long and fans out to over 50 miles in width. Three or four main channels are used by the river-boats, and some of the others have enough water for Arctic coastal schooners, but none are deep-water channels. The most serious delta problem met by the present transport companies is provided by the meandering channels, which often result in much lost time when the boats and barges cannot swing around the sharp bends without stopping, backing and manoeuvring.

The present northern terminal for river transportation is on the Arctic Ocean at Tuktuk (Port Brabant), slightly to the east of the delta mouth. River-steamers wait at Kittigazuit, at the mouth of East Branch, for calm weather before entering the open coastal waters. Since the water is shallow at the river mouth (5 feet) and across the bay to Tuktuk, captains usually try to leave on high tide (only about 18 inches), and even then the stern-wheelers can make very little speed in the shallow water.

The preceding description of the Mackenzie River route is not meant to be a guide for navigation. Its purpose is to sketch natural conditions and problem areas found along the river so that Canadians may know more about the possibilities of this northern route, and to illustrate river and lake conditions which govern the design and type of present-day craft. Although the Mackenzie system is a deep and broad waterway for most of its length, the controlling navigational factors are the low-water areas. Vessels, therefore, must be designed to proceed through both shallow river water and rough lake swells, and also be powerful enough to push upstream against a 6-mile current.



Picturesque Virginia Falls (316 feet) on South Nahanni River, a tributary of the Liard
R.C.A.F. photo

Mackenzie River Tributaries

Water transportation possibilities are not limited completely to the main Mackenzie waterway, for the chief tributary streams also contribute to the present system.

Peace River is a navigable river along most of its length, and steamboats once operated on it continually. The commercial practicability of this route is limited by the 14-foot fall 50 miles east of Fort Vermilion. At present one small motor vessel operates on the central part of the river between Peace River settlement and Vermilion Chutes.

Almost all of the rivers draining into Great Slave Lake have falls or rapids along their routes. Hay River drops over an escarpment which parallels the southern shore of Great Slave Lake, forming picturesque Alexandra Falls (109 feet) and nearby Louise Falls (50 feet) about 30 miles from its mouth. Taltson River, with numerous rapids and falls, is typical of most of the streams draining the rocky Canadian Shield. One of the scenic sights of the river is Twin Gorges Falls (90 feet), about 30 miles northeast of Fort Smith. Lockhart River drains Artillery, Aylmer and Mackay Lakes into the eastern end of Great Slave Lake. The river is a potential power site with three large falls (Tyrrell—85 feet, Parry—130 feet, Anderson—40 feet) within 15 miles of its mouth, and has been investigated by the Dominion Water and Power Bureau. A portage through a line of lakes south of Lockhart River is used as the canoe route to Artillery Lake and the Barren Grounds. [12] The rough, unnavigable rivers draining the multitude of small lakes into the north arm of Slave Lake (e.g., Yellowknife and Snare) are of similar character, having many rapids but no large falls. Investigations started in 1945 on the Snare River may enable a power site to be developed for the town of Yellowknife 75 miles away.

Liard River joins the Mackenzie at Fort Simpson and has its headwaters in the mountains of southern Yukon and northern British Columbia. The key importance of this river is due to its ice breaking up in early May, more than a month before Great Slave Lake is ice-free. By using the Liard route, the first supplies of the year (including very popular fresh fruit and vegetables) may be brought to the settlements of the lower Mackenzie much earlier, and at a time when spring beaver and muskrats are being traded at the stores. The potential value of this route has been further enhanced by the Alaska Highway, which passes through Fort Nelson, British Columbia, allowing freight to be trucked from the railhead at Dawson Creek, and thence down the Nelson and Liard Rivers in small boats.

During the past two years a few of the trading companies have pioneered the Nelson-Liard route by sending a small tonnage of supplies downstream during high water immediately after break-up. Prior to this time freight for Fort Liard was shipped upstream from Fort Simpson. The chief disadvantage curtailing the future of the Liard waterway is the fact that it is a mountain-fed river which has a rapid run-off in the spring, and by August water is too low for successful navigation. The Liard River has an advantage and disadvantage in its early break-up and source of headwaters; which of these will weigh more heavily in future development is yet to be decided and will be influenced by the degree of success of the new Grimshaw-Hay River road to Great Slave Lake.

Bear River has been used since 1934 as an important water route carrying heavy tonnages of pitchblende ore from the radium mine on Great Bear Lake. [15] Unfortunately, the river has a series of impassable rapids about 30 miles from its mouth which had to be by-passed with an 8-mile portage road. Freight has been carried from the portage road by flat-bottomed river-boats to the head of Bear River, where it is again transferred to larger lake-boats for transportation across Great Bear Lake. Since upper Bear River has an intricate channel, the portage road is being extended eastward from Bear Rapids along the south side of the river to the lake, and, with the completion of the road in 1946, the second unloading will be eliminated.

Arctic Red and Peel Rivers enter the Mackenzie near its delta. The Peel is navigated without difficulty as far as Fort

McPherson but no commercial use southward has been made of either river. Indian schooners proceed from 50 to 100 miles up both rivers, but the practical value of the streams is curtailed by numerous uncharted sandbars and low water in the fall.

Western Arctic Coast

A study of water transportation in the Canadian Northwest could not be complete without briefly outlining conditions which are met beyond the Mackenzie River along the Arctic Coast.* Because this area appears on the map as open ocean, there are many misconceptions as to present type of craft, amount of traffic and future possibilities.

During the later part of the last century the coast from Point Barrow, Alaska, to Herschel Island was much frequented by whalers who sailed in deep-sea vessels and often wintered in the area. Vessels of 17-foot draft could moor alongside the beach at Herschel Island. After the disappearance of the large whales this traffic gradually died out. Within the modern period some of the Arctic traders have brought vessels through the ice-floes to their northern posts, and, from 1925 to 1931, the Hudson's Bay Company had their large 1,300-ton ice-breaker *Baychimo* supplying their posts as far eastward as Cambridge Bay. Since its loss in the ice in 1931 no large ship has plied these waters; the trade has been left to smaller, and more efficient, coastal schooners. After 1936 the Alaskan route ceased to be used except by the historic R.C.M.P. schooner *St. Roch*, and once by the H.B.C. schooner *Fort Ross* (transferred from the Eastern Arctic via the Panama Canal).

Uncertainty of ice conditions was the chief reason for abandoning the coastal route for the more dependable Mackenzie waterway. The Arctic Ocean is a mass of ice-floes moving in a general clockwise direction throughout the whole year. During the short summer, however, the ice melts away from the coast and open water can be found. The navigational problem lies in the fact that the pack-ice is moved by prevailing winds. A north or west wind will push the floes southward against the Arctic Coast, impeding or stopping transportation and perhaps wrecking ships. An east or south wind, on the other hand, will keep the coastal strip open and allow vessels to slip through safely. (16)

At present, Tuktuk (Port Brabant) is the distributing centre from which freight for the Western Arctic is transferred from river-boats to coastal schooners. The usual

*More detailed information may be obtained from *Canada's Western Northland*, pp. 35-39.



Lady Richardson, *belonging to an Arctic coastal trader, and* Bonnie Belle, *an Eskimo schooner, at Aklavik.*



Eskimo schooners at Herschel Island in 1930

Photo by R. Finnie



Roman Catholic Mission schooner Immaculata *and another coastal schooner in Aklavik channel. Richardson Mountains are seen in background.* Photo by C. H. D. Clarke

schooners are small 25 to 75-ton vessels with shallow drafts of 6 to 12 feet. They are easily accommodated in the 14-foot harbour at Tuktuk. Most of the present supplies used by the Western Arctic posts are actually carried by three vessels, *Fort Ross*, *St. Roch*, and *Lady of Lourdes*, with lesser amounts being transported by smaller Eskimo schooners.

The schooners stay close to the coast in Amundsen Gulf, where their shallow draft often allows them to proceed inshore from grounded ice. In island-studded Coronation Gulf, navigation is easier during the generally ice-free months of August and September, and supplies are carried as far eastward as the posts at Cambridge Bay and King William Island. The possibilities of traversing the loosely-discussed Northwest Passage via this route are limited by a short open season, shallow water and lack of resources to support traffic. (16)

The Yukon Waterway*

In the opening-up and development of Yukon Territory the Yukon River played an important and continuous part. Although its length of almost 2,000 miles makes it the fifth river of North America, only a third of it lies in Canada. The publicity given to the Alaska Highway and the line of air bases has caused the steady and dependable water route to be overlooked. Until these current developments took place, most of the freight and supplies entering the Territory, and nearly all of the exported ores, were carried via the White Pass and Yukon Route (which includes the railway and water transport companies).

The navigation season on Yukon waterway lasts for a period of about five months, varying slightly in the spring. The first boats usually leave Whitehorse about May 15-25, as soon as Lake Laberge is free of ice, and the last boats are away from Dawson in

*Material compiled by W. F. Lothian at the Bureau of Northwest Territories and Yukon Affairs, Ottawa.



Suspension foot-bridge over Miles Canyon in Lewes River
W.P.&Y.R. photo

early October to arrive at Whitehorse for wintering by October 15.

From one of its southwestern sources in Summit Lake, British Columbia, within 15 miles of tide-water on the Pacific Coast, the Yukon waterway flows northward through Yukon Territory for 637 miles. The waters of other mountain lakes—Bennett, Tagish and Atlin, on the Yukon-British Columbia boundary—are ultimately combined into the Lewes River, which drains the north end of Tagish Lake.* Miles Canyon and the rapids south of Whitehorse are impassable to river traffic, so that the head of navigation, and northern terminal of the railroad, is at Whitehorse. Northward and westward the Yukon is navigable without interruption for a distance of 1,777 miles to its outlet through Apoon Pass in Alaska.

The present well-developed drainage system of the Yukon is greatly influenced by the past glacial history of the region. When ice-caps topped the mountains surrounding the Yukon plateau, glaciers fingered downwards and gouged deep and broad valleys into the plateau surface; large streams drained the glaciers and cut broad channels towards the main rivers. Since the disappearance of the ice-caps, the present streams have been supplied only by the low precipitation (9 to 13 inches annually) of the area, and are thus much smaller streams which meander across generally flat-bottomed valleys. (17)

Because the tributaries of the Yukon have their sources in the semi-circle of mountains around the central plateau, there is a difference in period of high water for navigation. Snow-fed streams, such as the Teslin, Pelly and, to a lesser extent, the Stewart, heading into the southeast and east, come quickly into flood after break-up in late May, and, by late July and August, they are dependent entirely on rainfall and may become quite shallow. The glacial-fed streams, Lewes and White, which rise in the scenic Coast and St. Elias Mountains (containing Canada's highest mountain) are slower in gathering volume and reach their peaks in July and August.

As a result of the above condition, Lewes River, north of Whitehorse, was still low when river transportation should begin, while the river north of the junction of the Teslin was high and at good navigation stage. This situation was remedied in 1925 when a dam was built across Lewes River above Whitehorse to hold back water during the late autumn and winter. The dam was progressively opened after May 1, and the release of water raised the level of Lake Laberge, breaking up the ice around the shore. This method has been successful in advancing the date of the opening of navigation from early June to mid-May below Whitehorse. The time of spring break-up in Lake Laberge, as in Great Slave Lake on the Mackenzie, is the key to the opening of navigation on the Yukon waterway.

No systematic survey of the channels of the Yukon has been made, but experienced river-men estimate that there is a minimum

*About half of the length of the Yukon waterway in Canada is called Lewes River on maps, the name Yukon being given north of the junction of the Lewes and Pelly Rivers at Selkirk. In the Territory the whole river is locally known as Yukon River.



Whitehorse Rapids south of Whitehorse, Yukon

depth of 4 feet at low-water stage in the main channel from Whitehorse to Dawson. Average depths are, of course, greater.

Although there are no obstructions to river transportation on the main Yukon waterway, there are a few places where navigation is hazardous and experienced pilots and captains are necessary. (18)

Between Lake Laberge and the mouth of Teslin River there is a stretch of fast water, with several boulder-strewn riffles and shallow rapids, known as "Thirtymile River". Work is done on this section each year by the Navigation Company and Dominion Department of Public Works, but anchor-ice, freed from the river bottom in spring, continually carries boulders and deposits them in the channel.

Twenty-five miles north of Carmacks, Five Finger Rapids are one of the navigation difficulties in the river. Here four small rocky islands split the river into five channels, of which only the eastern one is navigable for steamers. A current of about 10 miles per hour is a serious upstream handicap which is overcome by means of a cable from shore attached to power-capstans on the decks. The cable is also necessary during high water when there is a distinct fall in the rapids, causing the stern of the paddle-wheeled vessels to be above water, resulting in a momentary loss of power.

Six miles to the north, Rink Rapids cover sunken reefs lying at an angle to the channel. Navigation around this bend is accomplished by "jack-knifing" (angling the barges from the front of the steamer), so that the barges are carried out over the reef while the steamer remains in the channel. This method is also used in negotiating particularly sharp bends in the river.

At Fort Selkirk the waters of the Pelly swell those of the Lewes, and the resulting broader river is known as the Yukon. In

Five Finger Rapids in Yukon River north of Carmacks W.P.&Y.R. photo





Numerous islands and sandbars in Yukon River near Selkirk. Note the flat-topped, dissected plateau surface. R.C.A.F. photo



Silt-laden White River near its junction with the Yukon R.C.A.F. photo

the 90 miles from Selkirk to the junction of White River the Yukon is clear and gentle with numerous islands, lying chiefly in its central part, breaking the river into several channels. White River is a silt-laden stream entering the Yukon from the west, adding more bars and islands to the main river northward, but not hindering through-navigation. Below the junction of Stewart River the characteristics of fairly deep water, a gentle current, picturesque islands, wooded river terraces, and sloping hills in the distance are found along the Yukon to the boundary of Alaska, 88 miles from Dawson.

Yukon River Tributaries*

Most of the traffic and freight of Yukon Territory is carried on the main waterway, but several of the tributaries are navigable and have local steamer or gas-boat service. The scenic lakes along the Yukon-British Columbia boundary also have boat service during the five-month summer season.

Teslin River is navigable by the larger steamers throughout June and early July, but traffic ceases during the low-water period of late summer. This characteristic is also typical of Pelly River and its main tributary, the Macmillan, but, since there are no large settlements along these streams, only small barges with outboard motors currently use the rivers.

Stewart River is navigated by the river-boats, but has a channel which shifts each year. Because of its source in the high Mackenzie Mountains, the Stewart receives an important rise from rains during early September which prolongs the navigation season. Before the Treadwell-Yukon mine near Mayo closed in 1941, large steamers made twice-weekly trips up the Stewart during June, carrying down large tonnages of ore. In July and August, a smaller boat, drawing 2½ to 3 feet of water, pushing smaller barges, continued the transport service.

White River has been navigated by small stern-wheelers as far as Snag, 100 miles upstream. The river is high into late summer with no rapids, but the channels change location rapidly owing to the great amount of silt carried from the mountains.

Porcupine River joins the Yukon 321 miles below Dawson at the town of Fort Yukon, Alaska. Freight for the Indian settlement and trading-posts upstream at Old Crow, Yukon, is carried through Alaska in bond and delivered by small gasoline-driven river-boats.

Present Transportation**

Controlled by natural features, an efficient system of river transportation has evolved in Northwestern Canada, adapting

*Information supplied by Dr. H. S. Bostock, Geological Survey Division, Department of Mines and Resources.

**Information on Mackenzie and Yukon River systems supplied to the Bureau of Northwest Territories and Yukon Affairs by the companies named.

Steamer Whitehorse *in Five Finger Rapids, Yukon River* W.P.&Y.R. photo

itself to the limitations and advantages of the northward-flowing rivers. From time to time booms have occurred which found transportation facilities inadequate, and more equipment was constructed and improvements made. During 1942-44 the waterways passed through such a period of unusual activity in which many changes took place, and the present systems are adjusting themselves once more to peace-time conditions, being better equipped to handle normal traffic.

Freight on the Mackenzie waterway is carried by large barges pushed either by stern-wheeled steamers (formerly wood-burning, but converted to oil-burning in 1945), or by small propeller-driven, diesel-engined motor vessels. Although the steamers carry some passengers and tourists, the motor vessels are primarily concerned with transporting freight. At the close of the 1944 season, the four chief transportation companies using the river system, Mackenzie River Transport (Hudson's Bay Company), Northern Transportation Company Limited (now government-owned), Yellowknife Transport Company Limited (plying chiefly to Yellowknife) and McInnes Products Corporation Limited (mainly interested in exporting fish), had a total of four steamers (all M.R.T.), 23 motor vessels (14 north of Fort Smith), and 58 barges (including 3 refrigerated).

Barges are the distinctive sight of Mackenzie River transportation. [19] They were introduced after World War I in order to increase the capacity of each trip; as the North developed, freight increased, and the number of barges grew. Whereas the old steamers used to push one or two barges for peace-time traffic, in 1942 the *Distributor* pushed five barges, with a record load of 1,500 tons, in one trip to Camp Canol. Barges are usually pushed ahead of the blunt-nosed boats, two or three in a line, and the others are lashed alongside. The







Right centre:—
Northern Transportation Co. shipyard at Bell Rock, near Fort Smith; new steel barges are under construction.

Right:—
Hudson's Bay Co. river steamer Distributor *and four barges at Fort Norman*
Photo by Eric Fry

motor vessels are able to tow the barges in rough water—a feat which the stern-wheelers cannot accomplish. Since nearly all freight goes north by the barge method—from perishable fruits to heavy mining equipment—loading is a careful procedure which involves making certain that supplies for each settlement, in down-river sequence, are grouped together, and that the barge remains evenly loaded. [20] The ease and efficiency with which all-important annual supplies are delivered is apt to belie the amount of careful organization and difficult navigation which lies behind freight and passenger movement. [21]

One of the chief economic problems faced by the transportation companies is the small volume of southbound freight compared with the grand total of incoming supplies. The following table illustrates amounts of freight (in tons) moved on the Mackenzie waterway in recent years:

Year	Northbound from Waterways	Northbound into N.W.T.	Point to Point in N.W.T.	Southbound to Waterways x
1938	19,003	13,474	3,000	4,766
1939	16,521	8,550	4,045	4,996
1940	15,108	9,030	4,698	2,273
1941	19,364	13,613	4,471	3,123
1942	31,500 xx	15,794	10,892	2,981
1943	21,817		18,097	1,297
1943 (U.S. Army)	25,552			
1944	22,522 (inc. 7,639 for U.S.)			8,377xxx

xIncludes gas and oil from Norman Wells to Yellowknife.
xxIncludes 19,543 tons moved for Canol Project.
xxxIncludes 7,295 tons removed by N.T. Co. from Joint Defence Project.

Most of the freight moved along the waterway is handled by the two chief transportation companies, with the Mackenzie River Transport (H.B.C.) carrying the largest share of northbound supplies (chiefly trade goods and foodstuffs), and the Northern Transportation Company handling most of the southbound freight (chiefly ore and concentrates from the mines and oil from Norman Wells to Mackenzie District settlements). The great importance of water-borne freight is well illustrated in the following table, which compares average tonnages carried by the various water transport companies with the average total carried by air transport during the past seven years. Despite the undoubted value of aircraft in opening up and developing Mackenzie District these few figures graphically show the vital and steady role which the Mackenzie waterway has always played in the North.

Average Annual Tonnage Carried 1938-44

	Northbound from Waterways	Northbound into N.W.T.	Point to Point in N.W.T.	Southbound to Waterways
M.R.T.	13,909 (67%)	7,322 (60%)	3,454 (45%)	1,089 (27%)
N.T.C.	5,789 (28%)	3,741 (31%)	3,502 (47%)	2,824 (71%)
Others	1,135 (5%)	1,029 (9%)	578 (8%)	61 (2%)
By Air		166	297	36

In Yukon territory, one company, the White Pass and Yukon Route, carries most of the freight and passengers. It has eight steamers and gas-boats operating north of Whitehorse and two steamers on Lakes Bennett and Tagish. The largest of these boats average about 150 to 200 feet long, 30 to 40 feet wide, and have a gross tonnage of slightly over 1,000 tons. The steamers on the Whitehorse-Dawson run are wood-

burning, and stop to load fuel at various points along the river. Nearly all push barges when freight is the main consideration. In normal times a twice-weekly service between Whitehorse and Dawson was maintained, with the downstream trip taking about two days.

Freight tonnages handled in the Yukon are not as great as in Mackenzie District, and are largely dependent upon the state of the mining industry. On the other hand, the passenger and tourist trade was more developed in the Yukon than along the Mackenzie waterway. Normal freight movement (in tons) in the Yukon is illustrated by the following table:

	1939	*1941*
Whitehorse-Dawson	5,871	6,207
Mayo-Whitehorse	11,012 (inc. 9,050 tons of ore)	2,865x (inc. 1,900 tons of ore)
Dawson-Nenana, Alaska	1,240	1,532

xTreadwell-Yukon silver-lead properties closed in 1941.

Conclusion

New developments in the Canadian Northwest during the past three years may have some influence upon the future place of water transportation. (22) The line of airfields through Yukon to Alaska will probably not greatly affect the volume of traffic on the waterway, and may even increase it. The all-weather Alaska Highway only services the less-populated areas of the Yukon where river transportation never could adequately reach, and will undoubtedly prove an efficient way to distribute rail-borne supplies from Whitehorse to southeast and southwest Yukon. North of Whitehorse the broad Yukon waterway remains a cheap route over which to carry the Yukon freight.

In the Mackenzie Valley, airfields at every settlement north to Norman Wells mean that rapid passenger service is available throughout the year. Air express, however, does not compete economically with cheap water transport, and actually only assists the latter by removing some of the "rush" items from its cargoes. The new all-weather road which is to be constructed from the railroad at Grimshaw (west of Peace River, Alberta) north to the mouth of Hay River, on Great Slavé Lake, may be of more importance to the future of water transport.

The completion of the Hay River road will mean that two of the main physical problems of the Mackenzie waterway—low water in the Athabaska delta, and the rapids in Slave River—will be avoided, and an ultimate extension of the road to the vicinity of Fort Providence will by-pass the third major delay—the ice of Great Slave Lake. Since most of the freight along the road will be destined for Yellowknife, and will still have to cross Great Slave Lake, it will remain for the future to show whether transport by motorized equipment can be more economical than by water transport—even with the latter's delays, owing to low water, inclement weather, and the Fitzgerald-Smith portage.

The history of the Mackenzie Valley has always been closely connected with that of the waterway. If past historical events can predict future trends, the Mackenzie is about to begin a new era. Routes into the valley have changed over the years: La Loche Portage was replaced by Athabaska River when a wagon-road was constructed north from the end of steel at Edmonton; The Athabaska route was replaced by Peace River when rail connections reached the latter; both routes were replaced by the present waterway from McMurray when the railroad was extended farther into the Northland. The present road development shifts the balance in the other direction, back to the Peace River railway route and northward by road.

The Mackenzie waterway, with all its difficulties and problems, has done a magnificent job in carrying the needs and exports of the Mackenzie Valley. It has met many

transportation crises, and each time proved capable of supplying the residents at reasonable cost; but now a new and serious competitor is entering the field, and only the future will show how the southern part of the waterway will survive this latest development.

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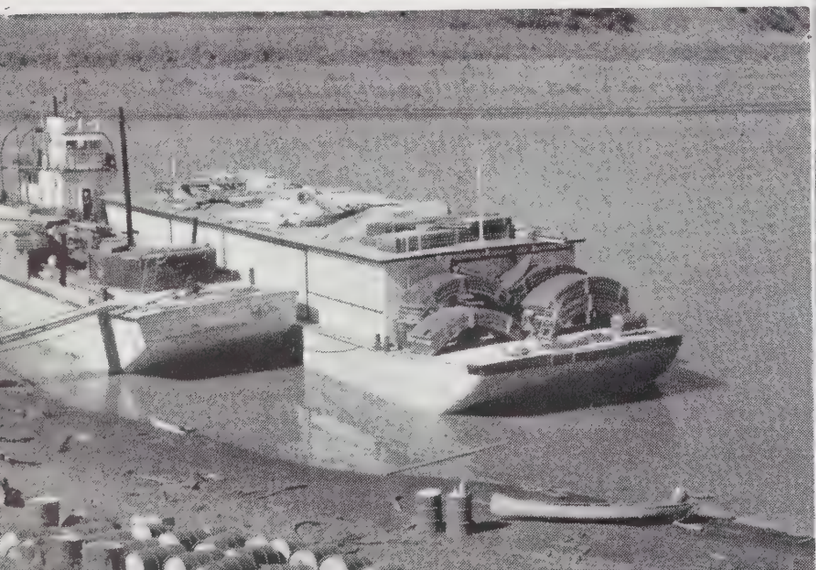
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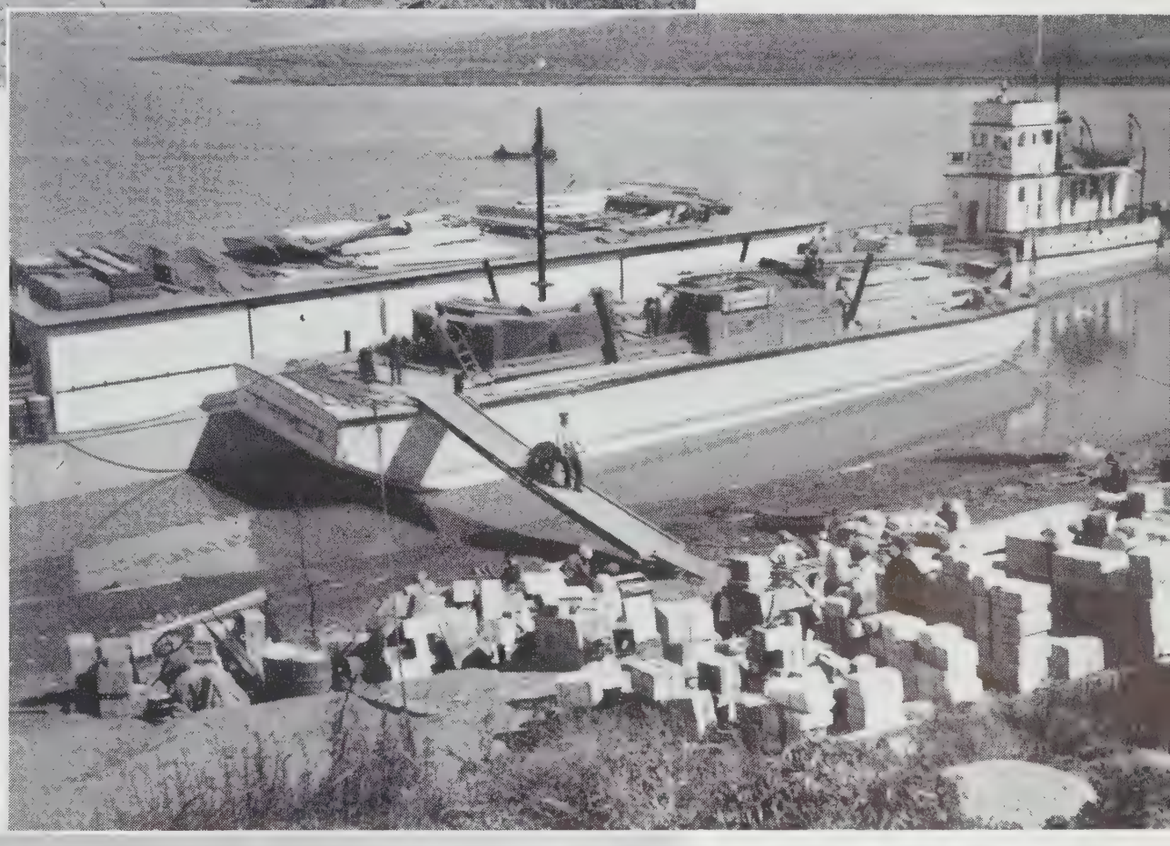
River-boats and barges (top to bottom):—
M.V. Clearwater *at Fort Fitzgerald*
Radium Queen *on Slave River* Photo by M. Meikle
The Slave *being repainted at Bell Rock.*
Barges being loaded with gasoline drums at Norman Wells.
Northern Transportation Co.'s Slave *unloading supplies at Arctic Red River.*







Flat-bottomed Indian schooners for river travel—at Arctic Red River



Annual supplies being unloaded from Mackenzie River barges.



The Hudson's Bay Company stern-wheeler Distributor



One of the diesel-driven tugs of the United States Army—now operated by the Imperial Oil Company at Norman Wells.

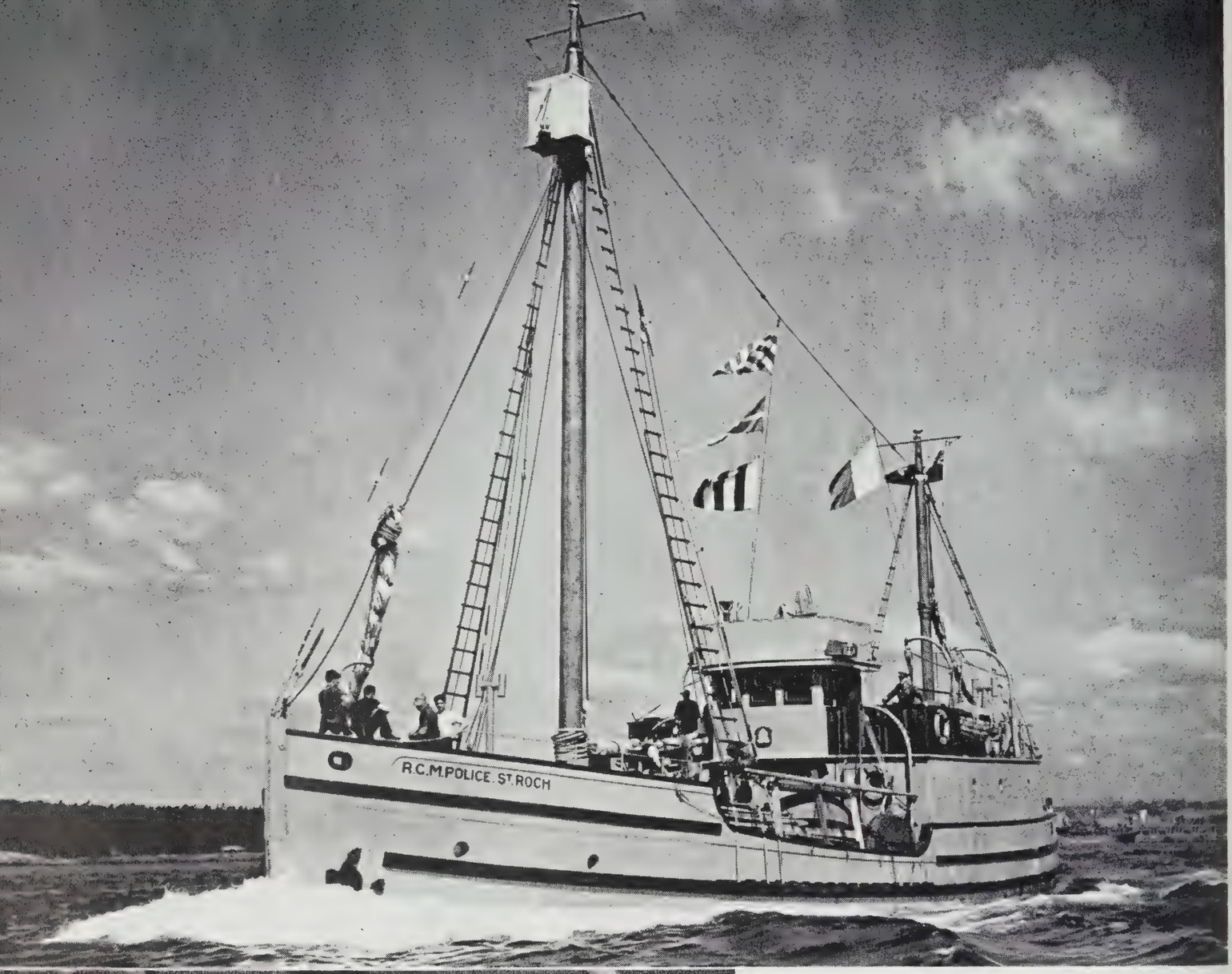


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Conquest of the Northwest Passage by R.C.M.P. Schooner St. Roch



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Top: R.C.M. Police schooner "St. Roch" leaving the harbour, Halifax, July, 1944. R.C.N. photo

Left: Staff-Sgt. Henry A. Larsen, Captain and Navigator on the "St. Roch" R.C.N. photo

Photos not otherwise credited
are by H. A Larsen

*Conquest of the Northwest Passage by R.C.M.P. Schooner St. Roch**

by J. LEWIS ROBINSON**

THE SEARCH FOR THE NORTHWEST PASSAGE forms an intriguing chapter in the history of Canadian exploration. The stories of early navigators who faced the dangers of polar pack-ice in tiny wooden sailing ships, travelling, with doubtful compasses, along uncharted coasts, are accounts of hardship, courage and perseverance. The fruitless quest for a route north of the North American mainland to the wealth of the Far East resulted in the exploration and charting of most of the numerous Arctic Islands of Northern Canada. As more and more knowledge of this inhospitable region was obtained through exploration, the trading incentive behind the search for a northwest route waned in the light of geographic facts which showed the route to be commercially impractical.

In the sixteenth century Europe began to look towards the new continent to the west, and expeditions from England, Spain, Portugal and France groped their way along the unknown coasts. At first this new land-mass was regarded chiefly as a barrier, of little value in itself, blocking the route to the fabled riches of the East. Exploration was interested in a way around or through it, and in 1576 Martin Frobisher first entered the Eastern Arctic seeking such a route. John Davis, who followed Frobisher's lead, reached Baffin Bay before the end of the century and noted several westward openings on the barren rocky coast.

Exploration in the early seventeenth century was side-tracked by the broad opening of Hudson Strait, and many years were spent in defining the limits of extensive Hudson Bay. The failure of several expeditions to find openings west of Hudson Bay dampened interest in the search in this direction, and for a time exploration was neglected.

After the Napoleonic Wars expeditions from the British Navy renewed the search for a northern route through the sea reported north of America. Edward Parry entered Lancaster Sound in 1819 and twisted through eastward-moving ice-floes as far as Melville Island before freezing his ship in for the winter. The next season ice choking the channel to the westward prevented further progress, and Parry returned to England. In 1821 Parry tried the southern route through Hudson Strait and Foxe Channel, and reached the entrance to Fury and Hecla Strait before being stopped by ice. Later attemps to pass through this strait also failed, and it has not yet been navigated by other than Eskimo mariners. Further exploration by John Ross, beginning in 1829, confirmed the existence of Boothia Peninsula extending north from the mainland of Canada and discouraged all hopes for a passage through this region. Since Ross did not see Bellot Strait, the strategic opening to the west, it was believed that Somerset Island was part of this long barrier peninsula.

In 1845 Sir John Franklin led a British Naval expedition into Lancaster Sound, and, after being stopped by ice in Barrow Strait, wintered at Beechey Island, the southwestern corner of Devon Island. The next year he continued westward and was lost, never to be seen again. Despite the fact that sixteen rescue expeditions entered the Arctic from both the east and west, discovered 6,000 miles of new coastline in their search, and covered about 40,000 miles by winter sledge trips, Franklin's fate remained a mystery until M'Clintock brought out some

*Article prepared at the Bureau of Northwest Territories and Yukon Affairs, Lands, Parks and Forests Branch, Department of Mines and Resources, Ottawa—based on interviews with and reports from Staff-Sergeant (now Sub-Inspector) Henry A. Larsen of the Royal Canadian Mounted Police, and published by permission of the Commissioner, Royal Canadian Mounted Police.

**Geographer at the Bureau of Northwest Territories and Yukon Affairs, Ottawa

clues in 1859. This extensive search well illustrated the vastness of the Canadian Arctic. Many famous explorers, whose names are now commemorated on our maps, travelled widely by small boat in summer and by sledge in winter, and their mapping brought forth the first definite outlines of the Arctic Islands. All their accounts lay stress on the short navigation season after the land-fast ice breaks up, on being obstructed by extensive masses of pack-ice moving eastward from the Arctic Ocean through the many channels of the Arctic Islands to Baffin Bay and the North Atlantic, and on an early freeze-up followed by a severe winter, with sledges as the only means of travel.

In 1854 the long-sought Northwest Passage was finally traversed by Captain M'Clure and part of his crew. They abandoned their ice-bound ship north of Banks Island in 1853 and sledged eastward to meet Captain Kellett at Dealey Island. The next spring M'Clure sledged to Beechey Island and was brought out from there by ship. When the news that the difficult route had been found was combined with geographic information which was reported on ice and navigation conditions by the many expeditions, enthusiasm for the Northwest Passage declined among explorers. In the meantime, commerce now knew safer and more dependable routes to carry the world's merchandise, and no longer encouraged interest in the Passage.

The Northwest Passage, which had brought so many ships to destruction in the ice during three long and arduous centuries of polar exploration, remained unconquered by any one vessel until the beginning of the present century. In 1903, Roald Amundsen, Norwegian Arctic adventurer, entered Lancaster Sound in a small 47-ton vessel, the *Gjoa*, and took a route southward into uncharted Peel Sound, between Somerset and Prince of Wales Islands. He navigated as far as southeastern King William Island, where his party spent two winters at Gjoa Haven (Petersen Bay), studying terrestrial magnetism near the North Magnetic Pole on western Boothia Peninsula. In leaving the Arctic, Amundsen sailed westward through Queen Maud and Coronation Gulfs but was caught in the ice near Herschel Island, where he passed his third winter in 1906. Next summer he and his crew continued westward, becoming the first persons to navigate the Northwest Passage successfully from east to west in a single ship.

Within the modern period the Hudson's Bay Company has experimented with the use of the northern route to bring supplies to its far-flung northern trading posts. In 1928 the H.B.C. schooner *Fort James*, drawing 9 feet of water, entered the Western Arctic from the east through Lancaster Sound and Peel Strait and brought supplies to the Gjoa Haven trading post on King William Island. After spending two winters there, the *Fort James* returned to the Eastern Arctic via the same route. This was the first commercial use of part of the passage, but when the *Fort James* was sent to the Western Arctic in 1934, she travelled via the Panama Canal.

In 1937 the Hudson's Bay Company icebreaker *Nascopie*, carrying the Canadian Government Eastern Arctic Patrol, opened the trading post of Fort Ross at the eastern end of Bellot Strait, and here met and exchanged freight with the small H.B.C. schooner *Aklavik*, which came up from King William Island. Thus Bellot Strait, which had five times defied Captain M'Clintock and his *Fox* in 1858-59, became the meeting-place between the Eastern and Western Arctic on the Northwest Passage. Shallow seas along the western section of this route, however, limited the size of boats to small schooners like the *Aklavik*, causing the route to be of little economic value, and the scheme was dropped in 1940.

The boat which was to make history in the Northwest Passage, the R.C.M.P. schooner *St. Roch*, was built in 1928 and entered the Western Arctic around the Alaskan coast. In the following years the 80-ton, two-masted vessel travelled along the Western Arctic coasts and islands as a "floating police detachment", carrying sup-

plies and doing routine patrol work without fanfare, through the same difficult ice conditions which had cost so many ships and lives among the early explorers. These hardy adventurers were able to brave only one or two winters in the Arctic, but the sturdy *St. Roch* has spent ten of her sixteen years frozen into the ice of some Arctic harbour. Four successive winters, 1930-34, were spent at Tree River, in Coronation Gulf, and three winters, 1935-37 and 1938-39, were passed frozen in at Cambridge Bay. Aided by modern equipment and radio communication, the R.C.M.P. boat has been performing feats of Arctic ice navigation equal to those history-making voyages of less than a century ago. But to Staff-Sergeant Henry A. Larsen, who has been the unassuming Captain of the schooner during all of these years, this difficult work of navigation and long winter dog-sled patrols are the usual routine in maintaining law and order in the Canadian North.

On June 23, 1940, the *St. Roch* left Vancouver, British Columbia, beginning the historic voyage which was to make the 80-ton schooner the first ship to complete the elusive Northwest Passage from west to east. The voyage northward through the Inside Passage and across the north Pacific to the Aleutians was uneventful. The *St. Roch* entered Bering Sea through Unimak Pass and anchored at Akutan Harbour to check her engines and fill the fresh-water tanks. The schooner continued to Dutch Harbour in the Aleutians on July 8 to load a supply of fuel oil for the diesel-powered engines. Adverse weather, with strong winds, rain, and fog, was met in crossing Bering Sea and, after stopping at Teller Harbour for a day, the *St. Roch* passed through Bering Strait in a dense fog and entered the Arctic Ocean on July 17.

On July 23, the *St. Roch* rounded Point Barrow spit and met the first loose-scattered ice-floes. By evening the blocks had become

Captain and crew of the "St. Roch" at the end of the first historic voyage, 1940-42. Left to right: Const. W. J. Parry, Cook; Const. P. G. Hunt, Deckhand; Const. E. C. Hadley, Wireless Operator; Staff-Sgt. H. A. Larsen, Master; Const. F. S. Farrar, Mate; Const. J. W. Doyle, Deckhand; Cpl. M. F. Foster, Engineer; Const. G. W. Peters, 2nd Engineer R.C.M.P. photo





"St. Roch" frozen in and covered over in winter quarters.

more numerous, and the *St. Roch* began the familiar task of slowly "working the ice"—twisting and turning from one lead to another opening, edging around large floes and pushing aside small blocks, drifting with the pack and waiting for a lead to appear; Larsen and the *St. Roch* had been doing this patient work in partnership since 1928. Progress was slow and it became apparent that this was going to be a bad year for ice along the northern Alaskan coast.

Ice conditions are unpredictable in the Arctic, and are greatly dependent upon prevailing winds. The polar pack-ice, which moves in a general clockwise direction in the Arctic Ocean, presses southward against the Alaskan coast. In years when prevailing winds are easterly or southerly, the ice is moved westward and leaves an open strip along the coast; but northerly winds will pack the floes against the shore, impeding or blocking passage. Although this northern route was formerly used by whalers, many were lost during bad years, and since 1936 only the H.B.C. schooner *Fort Ross*, in addition to the *St. Roch*, has entered the Western Arctic via this route. Small schooners have more success along the Alaskan coast because they can travel close to shore inside of the ice which grounds in the shallow coastal water. The only large ship to attempt this route, the H.B.C. icebreaker *Baychimo*, after a few successful trips was caught in the ice off Point Barrow in September, 1931, and abandoned.

For eighteen days the *St. Roch* struggled in the pack-ice, east of Point Barrow. During much of this time the schooner had to be continually tied up to large floes for protection, and movement was mainly concerned with preventing the ship from being crushed. The weather was constantly foggy, further curtailing chances to see leads. At one time the *St. Roch* was able to anchor close to shore near Beechey Point, but as the ice began to close in again Larsen had to put the schooner back into the pack to avoid being shoved ashore. It was then moored to





Above: Loading a basket-sled for winter patrol to Eskimo camps.

Top right: Const. Peters and Eskimo guide encamped on Prince of Wales Strait.



Centre: Native boy with dog-team hitched in Western Arctic style.

Below: Snow-houses in Eskimo winter camp





Left: Heavy ice-floes packed solidly.
Photo by J. L. Robinson

Centre: "St. Roch" stuck in ice off Boothia Peninsula.





Right: Heavy ice loosely packed.
Photo by J. L. Robinson

a grounded floe for two days so as not to lose distance by being pushed westward during a furious northeasterly gale. On August 2 the police vessel resumed working eastward and reached Cross Island before being caught once more. Northwest winds jammed the ice against the shore and pressed hard against the boat, so that on August 10 Larsen had to start blasting the ice in order to work free. After each blast the schooner charged into the opening and finally reached open water near shore. Thereafter good progress was made eastward, although the vessel scraped bottom several times. Barter Island was passed on the morning of August 11, and very little ice was encountered between there and Herschel Island.

After loading coal and other supplies, the *St. Roch* left Herschel Island on August 18 and crossed Mackenzie Bay to Port Brabant (Tuktoyaktuk or Tuk-tuk). From this harbour the police schooner continued her normal routine patrol work of carrying supplies to the various R.C.M.P. detachments in the Western Arctic. Bad weather, fog and strong winds caused several delays in the eastward trip to Coppermine and Cambridge Bay, and it was not until September 16 that the schooner returned to Coppermine with her freighting duties finished.

Captain Larsen had originally hoped to proceed through the Northwest Passage via Prince of Wales Strait between Victoria and Banks Islands after completing the freighting work, but the delays caused by ice and bad weather discouraged any such attempt so late in the season. A decision was then made to winter either on Banks Island or at Walker Bay on central west Victoria Island, and to be ready to navigate the Passage early the next summer. The *St. Roch*, therefore, left Coppermine on September 19 and went to Holman Island and thence to DeSalis Bay, Banks Island.

September 25 was spent in examining the enormous harbour and surrounding country at DeSalis Bay, but when Larsen noted high ridges of rock and gravel pushed up along the shore, indicating heavy ice pressure during break-up in the spring, he considered it unwise to winter here. Since no other good harbours were known in the area, the *St. Roch* sailed for Walker Bay, where the explorer, Collinson, had wintered in 1851-52. The vessel had a total of 5,240 miles to show for a season's work when she was anchored in the southeastern part of this bay.

A continuous strong east wind blew during most of October and prevented Walker Bay from freezing over until October 30. It was the latest freeze-up known in this area, and, if Larsen had had any way of knowing that it was to be so delayed that year, it is possible that he might have been able to make his way immediately through the Passage to the Eastern Arctic. The vagaries of Arctic weather are unpredictable, however, and what is done in one year may not be possible in another. After the schooner was frozen in, a framework was constructed and the deck was completely housed over with canvas.

During the winter of 1940-41 the *St. Roch* detachment made several normal patrols through the area, visiting native camps to investigate Eskimo conditions and welfare, registering vital statistics and firearms, and generally carrying out the many other duties of the R.C.M.P. in supervising this vast Arctic region. As is customary, travel was by Eskimo dog-team and sled, and the nightly shelter was a snow-house of their own construction. Short patrols totalling 990 miles were made to Holman Island for mail, to Minto Inlet, to Prince of Wales Strait and inland on Victoria Island. One especially long patrol of 41 days, covering about 600 miles, was made for the purpose of visiting the prosperous Eskimo camps on the western side of Banks Island.

During the spring, when days became longer, the vessel and equipment were scraped and painted and all machinery was examined and overhauled. The ice in the harbour began to break up in July, but westerly winds kept Walker Bay blocked with floes for some time. On July 31, Larsen decided to try to work his way out, and, after much manoeuvring, finally reached the trading post and mission at Holman Island.



Natives from Thom Bay, Boothia Peninsula, in workaday clothes

Here duty intervened, preventing the schooner from attempting the Passage through Prince of Wales Strait. A native boy had been accidently shot and needed to be taken to hospital at Aklavik. Large and numerous ice-floes, foggy weather, and a storm off the mainland coast made progress slow, and the harbour at Port Brabant was not reached until August 5. Whereas Amundsen Gulf had been free of ice until very late in the preceding year, during the summer of 1941 floes jammed the northern part of it throughout the whole season. Thus does the natural environment limit planning in the Western Arctic.

Supplies were loaded into the *St. Roch* at Port Brabant on August 8, and the vessel left for Coppermine to fulfil her freighting duties. Scattered ice, rain and fog made travel to Baillie Island difficult, while large unbroken floes extending eastward to the horizon forced the schooner to travel along the shallow shores. Open water was finally reached in Dolphin and Union Strait, and the vessel arrived at Coppermine on August 12. Coronation Gulf favoured the *St. Roch* with good weather and open water, and she anchored in Cambridge Bay early on August 16.

Since the detachments had now been given their year's supplies, Larsen decided to continue eastward and attempt the Passage around King William Island and through Bellot Strait. On August 19 he left Cambridge Bay, but strong westerly winds, rain and fog were ill omens. Larsen was forced to anchor in the shelter of Lind Island and was held there until August 24. The compass



Winter quarters of "St. Roch" at Pasley Bay, Boothia Peninsula



Native women of Bathurst Inlet in holiday attire

was now useless, owing to the proximity of the Magnetic Pole, and navigation through island-studded Queen Maud Gulf was by experience and seaman's 'sixth sense'. The *St. Roch* proceeded cautiously towards Simpson Strait, south of King William Island, taking soundings continually, since no vessel of her draught (13 feet) had ever been in these waters. Because Simpson Strait is narrow and full of small rocky islands, Larsen sent the motor launch ahead to sound a course. The bottom was uneven, with depths averaging from 6 to 8 fathoms, and with several shallow places of 3 fathoms. On August 26 the vessel remained at anchor during a thick fog. The next day she proceeded carefully and reached Gjoa Haven (Petersen Bay) in the afternoon.

The sea-faring policemen left this trading post on August 30 and were soon inching their way through shoal water and strong tide rips in Rae Strait. A northwesterly storm, accompanied by hail and snow, forced the schooner to the coast in the shelter of Mt. Matheson, on the eastern tip of King William Island. Here she pitched and rolled for a day before proceeding northward, with one man continuously sounding with the lead and another at the masthead on the lookout for shoals. East of Matty Island large shoals, which rose abruptly from 10 to 2½ fathoms, forced the schooner to seek deeper water.

In the narrowest part of James Ross Strait, northeast of Matty Island, the *St. Roch* was stopped by a solid wall of grounded ice extending from shore to shore. Since the vessel was not built or powered to break such



Staff-Sgt. H. A. Larsen on the trail—visiting Eskimo camps.

a barrier, she was anchored near by to wait for the tide to change direction. Early in the evening the ice began pushing southward in a strong current. The only shelter available was in the lee of a small rocky islet only slightly larger than the schooner herself. A snow-storm shut off visibility, and throughout the night the *St. Roch*, with both anchors out, was continually battered and pushed by grinding ice blocks, and the little company on board did not know whether they were still near the islet or were caught in the ice. The morning of September 2, however, found them still there and undamaged, and when a south wind began pushing the ice northward they moved along with it.

On September 3, improved weather allowed the *St. Roch* to proceed northward between the coast and the ice. The low land was now snow-covered, and when visibility became poor the white shore could not be distinguished from the grounded ice. During the day the wind changed to the west, gradually moving the ice closer to the coast. It became apparent that there was a definite danger of being caught and crushed. Fortune was with the valiant ship, however, for Pasley Bay, a long inlet, erroneously shown on the charts as a broad bay, appeared ahead, and the *St. Roch* was forced into it.

The next morning its crew made a trip to a near-by hill to look westward over the ice of Franklin Strait and M'Clintock Channel. It was jammed against the coast as far as could be seen, and extended in a jumbled mass to the horizon. In the afternoon large floes began to shove into the inlet, and the *St. Roch* had to move farther in. Soon the ship was completely surrounded by heavy ice and could no longer manoeuvre. On the morning of September 6 the ice carried the vessel against a shoal in 1½ fathoms, turned the schooner twice, listed it to alternate sides, and then pushed it completely over the shoal, dragging two anchors and 90 fathoms of chain.

Heavy snowfall and variable winds continued, and the *St. Roch* remained locked in the ice until September 9, when deep water was found in an opening close to the shore. On September 11 the ice movement ceased. New ice soon formed rapidly in the open places, and the whole inlet froze over solidly. As it was now impossible to escape, the ice was cut away from the ship, which was anchored farther off-shore so as not to be grounded in the spring. Preparations were then made to spend the winter in Pasley Bay, close to the North Magnetic Pole on Boothia Peninsula, and the news was radioed outside. The schooner had travelled 1,660 miles during the summer. The season was still early by normal standards, and Bellot Strait and the Northwest Passage were only 100 miles away, but the fickle Arctic had again frowned on the *St. Roch*.





Grave and cairn of Const. A. J. Chartrand, who died during the winter at Pasley Bay.

The stranded R.C.M. Policemen had an important task to perform during the winter of 1941-42. In the taking of the census of the Canadian Arctic areas, their job was to meet as many as possible of the Canadian Eskimo in this little-visited region. In order to do this Larsen travelled by dog-team to the trading post at Fort Ross in early December and obtained information as to the location of the native camp-sites in the area. In early January Constable Chartrand patrolled to King William Island to prepare a fish cache for the long spring census trip, and also to bring back additional winter clothing made by the natives for the detachment. Towards the end of February, Sergeant Larsen and Constable Hunt, having picked up a native guide, left their winter headquarters on the *St. Roch* for an epic patrol which was to cover 1,140 miles and extend over a period of 71 days. They travelled north to Fort Ross and beyond to Creswell Bay, then southward along the east coast to Boothia Peninsula to the mission at Pelly Bay. After spending Easter there, they travelled westward to Gjoa Haven, King William Island, where both were laid up for fourteen days with influenza. This illness curtailed the patrol, and they returned to the *St. Roch* on May 6.

The winter weather at Pasley Bay was quite different from any other that Sergeant Larsen had known previously in the Arctic. Continued fog and snow-fall with variable winds made visibility poor, while sudden changes in temperature from 30 below zero to zero and back again within a short time made it difficult to become acclimated. As summer approached it became apparent that the ice was not going to break up early in this region. It was still packed solidly outside the inlet, and pressure ridges, 50 to 100 feet high along the coast north of Pasley Bay, showed the results of enormous ice forces. Since the ice was to remain that year there was virtually no navigation season for the west side of Boothia Peninsula during the years 1941-42.

The *St. Roch* and police crew spent eleven months at Pasley Bay. On August 4, fresh water draining into the harbour loosened the ice and allowed them to move out of the inlet. On the shore behind they left a new cairn and grave. On February 13, Constable Chartrand had had a sudden heart attack and died almost immediately; his death was the only tragedy of the trip.



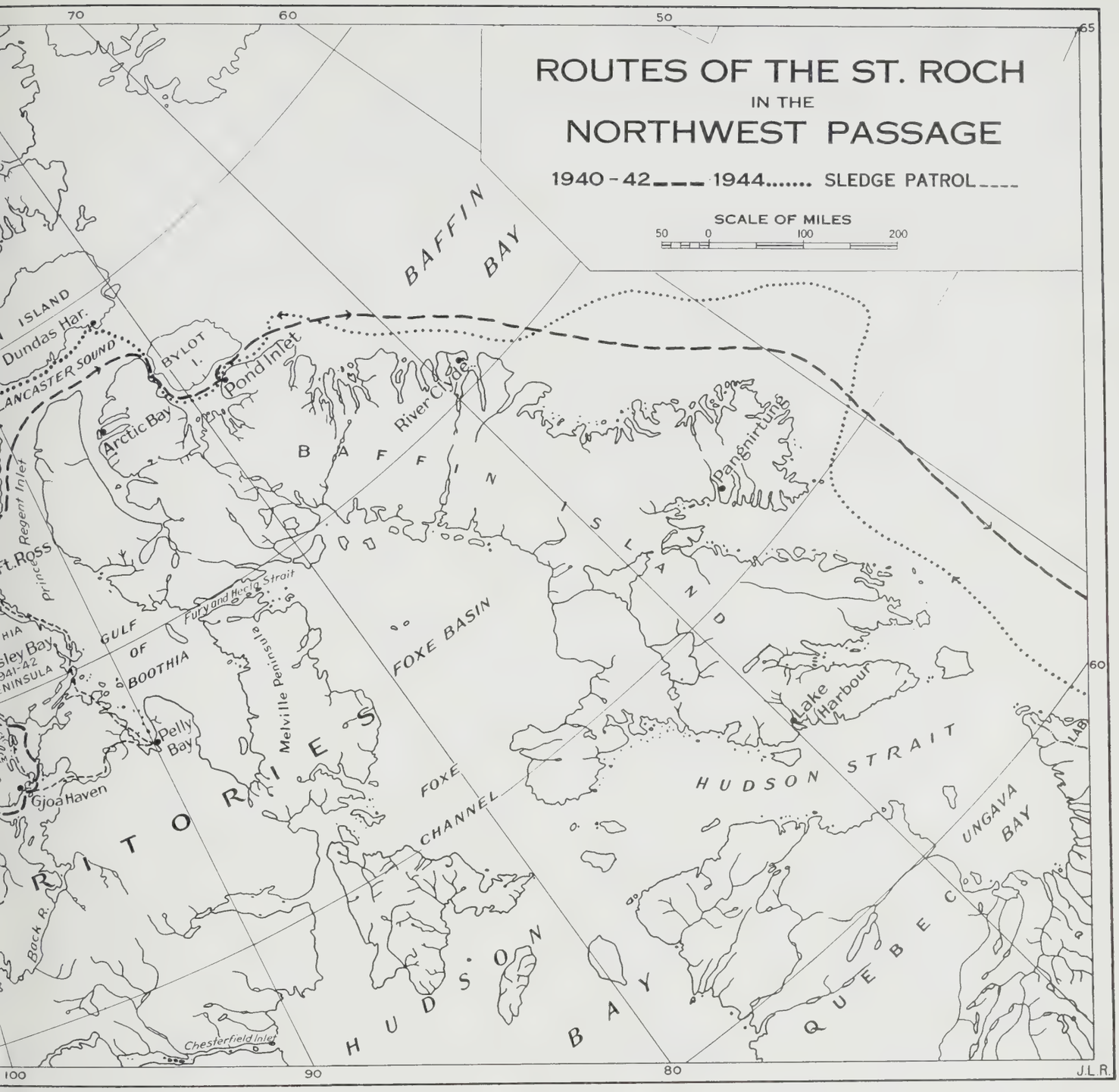
"St. Roch' ready to leave Pasley Bay, August, 1942.



Map of routes taken by "S

Captain Larsen navigated shoreward of the main pack-ice and made 15 miles northward along the coast before being stopped by a solid mass of floes. He then put the vessel into a small lead extending westward to await a break-up. The opening closed, however, and the schooner was caught and held there helpless for twenty days. On several occasions, while they were beset, severe pressure lifted the boat high in the ice and threatened to turn her over. At these times charges of black powder were set off near the vessel to relieve the pressure, while the police crew worked with ice-chisels to keep free the propeller and rudder. An easterly wind carried the schooner farther and farther away from the coast.

On August 24 a strong northerly gale split the ice and opened a long lead south from one of the rocky Tasmania Islands. It took two anxious days for the *St. Roch* to break through the short distance to the lead and then to follow the twisting, grinding opening to the safety of a deep anchorage among this small group of high islands. A strong current set back and forth through the islands, with



leting the Northwest Passage.

the regular 5-foot tide, and on August 29 Larsen decided that the leads looked promising. They worked northward to Dixon Island and then found easier going to Bellot Strait.

With the Northwest Passage practically in their grasp, tragedy almost struck the *St. Roch* and crew in Bellot Strait. The western end of the strait was free of ice, but the tide was changing direction to the eastward as the vessel entered. The ice from Peel Sound was carried in behind them. Half-way through the strait, Larsen suddenly saw that an ice-jam had formed ahead from shore to shore. They could not turn back and were headed for a large, thick, grounded floe. Then, just as they were about to crash and be wrecked, a smaller floe hit the larger one and broke off its southern half. The next moment the *St. Roch's* prow went into the widening crack and she drifted forward between the two floes.

The *St. Roch* left Fort Ross on September 2, surrounded by moving floes, and worked north in Prince Regent Inlet, with young slush ice already forming. The *Nascopie*, on

the Eastern Arctic Patrol, was to have entered this inlet later in the month, but although she had reached Fort Ross successfully for five previous years, she was stopped this time by the ice which was already threatening the *St. Roch*. The hurrying schooner entered Navy Board Inlet and stopped at the Pond Inlet post on Northern Baffin Island to discharge stores and coal for the police detachment and to pick up Constable Doyle. On September 10 it left this Eastern Arctic post and travelled through numerous bergs and storms southward along the Baffin Island and Labrador coasts.

After stopping at Labrador, Newfoundland and Sydney, Nova Scotia, the *St. Roch* and crew arrived in Halifax on October 11, having travelled 2,840 miles *en route* during their third summer season. The historic news that the *St. Roch* was the first ship to complete the west-to-east voyage through the Northwest Passage in Northern Canada was then released. The trip of 27½ months bettered Amundsen's time, and, with improved weather and ice conditions, it might well have been less. To Staff-Sergeant Henry A. Larsen this historic feat was an achievement of which to be proud, but nothing about which to become excited. He and his police crew had been travelling around amid the ice-floes of the Western Arctic in good and bad seasons for fourteen years, and had conquered the Passage as a side-activity while successfully carrying on with their other police duties. Larsen discounted his long winter patrols by Eskimo dog-team and sled as something which the R.C.M. Police are doing every winter throughout the Arctic in keeping contact with our migratory Eskimo population.

During the 1943 navigation season the *St. Roch* had a change of scenery while patrolling the Eastern Arctic detachments. She entered Hudson Strait after most of the ice had gone, and had little trouble in sailing around in this new region with no ice impediment except the huge bergs met off the eastern Baffin Island coast. The Eastern Arctic, however, is not always so friendly.

During the spring of 1944 the *St. Roch* was provided with greater engine-power, one mast was removed, and she was fitted with the luxury of a new gyro-compass. The R.C.M.P. were going to patrol another route through the Arctic Islands as part of Canada's work in maintaining sovereignty over these barren, uninhabited islands, and the partnership of Larsen and the *St. Roch* was scheduled for another history-making voyage.

On July 22, 1944, the *St. Roch* left Halifax, but developed engine trouble which forced her to put in to Sydney. She left there on July 26, but had to moor again at Curling Cove, Newfoundland, to make further engine adjustments. On July 28, she put to sea once more, and thereafter had no further engine difficulties. Numerous bergs and thick fog were found off the Labrador coast, but Larsen navigated around icebergs just as efficiently as he worked through floes. Cape Chidley, the northern tip of Labrador, was passed on August 2, and the next day the patrol was greeted with the familiar sight of pack-ice off Hall Peninsula, Baffin



"St. Roch" in dry-dock at Halifax, N.S. Her wooden hull is undamaged despite two years in the ice. Note the steel plates on the prow.

Island. The ice was broken, but tightly packed, and progress was impossible, so Larsen swung over to the usual open water off the Greenland coast on August 4. On August 6 he turned westward towards Baffin Island, and again met pack-ice and fog slightly south of River Clyde. For several days the gyro-compass had been unreliable, and would suddenly change 10 to 20 degrees; finally it had to be ignored as useless. Larsen's navigation from then onward was by sight, experience and the wavering magnetic compass.

In trying to work through the ice to travel near the coast off River Clyde, Larsen found that the land-fast ice had not yet broken up and he had to stay offshore. His difficulties were further increased by an amazingly strong mirage effect which made the leads difficult to pick out. Progress was stopped on August 9 by floes that were very large and unbroken, although only about 2 feet thick. Bylot Island was glimpsed through a thick fog that evening, but the *St. Roch* remained moored to a large floe off the entrance to Pond Inlet until August 12, when she slipped forward and anchored off the post settlement.

Detachment supplies were unloaded at Pond Inlet, and the police picked up a native, his family and seventeen dogs. The Eskimo was quite willing to adventure into the unknown, and so, in case the *St. Roch* should be forced to winter, he was taken along to hunt food and aid in winter travelling with his dog-team. The expedition left





Picturesque Pangnirtung fiord, the last stop of "St. Roch" on her 1943 patrol
Photo by P. D. Baird

Pond Inlet on August 17 and, proceeding up Navy Board Inlet, crossed Lancaster Sound to Devon Island. A strong southerly gale off Cape Warrenden caused the *St. Roch* to pitch a great deal before shelter was found in the lee of a large flat-topped iceberg. There it cruised back and forth until the storm subsided.

The *St. Roch* arrived at the former R.C.M.P. post at Dundas Harbour, Devon Island, on August 18, and found the unoccupied buildings in good condition. The patrolling schooner and police crew left the next day and followed along the high, cliffy coast until they came to a good harbour in a little-known 7-mile inlet (either Stratton Inlet or Burnett Creek). Here they found ruins of an Eskimo culture of several centuries ago; after building a cairn and depositing records of their visit, they departed. That evening (August 19) the first snow fell, heralding the coming winter.

Larsen and the *St. Roch* continued westward, but the coastline was usually hidden by frequent heavy snow-squalls. The weather cleared near Maxwell Bay, Devon Island, and they saw a steep-walled coast with no beach and a flat-topped upland. A few bergs could be seen to the south, but otherwise

The twisting inlet at Lake Harbour; "St. Roch" called here in 1943 Photo by J. L. Robinson



Captain and crew of 'St. Roch" before the record-making 1944 voyage.

Front row, left to right: Const. James Diplock, Huntsville, Ont.; Cpl. G. W. Peters, Winnipeg, Man., Cpl. P. C. Hunt,* Victoria, B.C.; R. Johnson, Vancouver, B.C.; Staff-Sgt. H. A. Larsen,* Victoria, B.C.*

Back row, left to right: Const. M. G. Owens, Winnipeg; G. Dickens, Chatham, N.B.; Frank Mathews, Fort Abass, Nfld.; Wm. Caslin, Dartmouth, N.S.; Ollie Andreasen, Victoria Landing.

*Peters, Hunt and Larsen made first trip, 1940-42.

Prince Regent Inlet was free of ice. On August 20, they arrived at historic Erebus Bay, Beechey Island.

Beechey Island is actually connected to Devon Island by a low spit which is dry at low tide. A narrow lowland at the base of the former high cliffed 'island' was the site of the winter quarters of several early Arctic explorers. Within recent times the site had been visited by one of Otto Sverdrup's sledge parties in 1902, by A. P. Low in 1904, by Captain Bernier in 1906 and 1908, and by the C.G.S. *Arctic* in 1923. Numerous police patrols from Dundas Harbour, and also the *Beothic*, carrying the Canadian Government Eastern Arctic Patrol in 1927 and 1928, called there to keep a watchful eye on the historic ruins. Except for part of the keel and a bit of planking, all that was left of the yacht *Mary*, placed there in 1850 by Sir John Ross, was the mast, which was stuck in the sand. Only ruins remained of the cache called Northumberland House, left by Commander Pullen of the H.M.S. *North Star* in 1854. A further search of the island revealed nothing of historic interest. Since the land was barren and desolate, with no fresh-water supply, the *St. Roch* proceeded from Beechey Island on the morning of August 22.

Wellington Channel was clear of ice as far as could be seen to the northward, but the first floes were met drifting eastward at Cornwallis Island. Larsen followed leads through the tightly-packed floes, staying inside of the line of Griffith, Somerville and Brown Islands, along the Cornwallis Island coast. Several walrus were seen in this area, and four were shot and brought on board to



Passing glaciers and ice-cap along Baffin Island coast of Navy Board Inlet.
Photo by P. D. Baird

be used as dog-feed. At other times, along the way, seals were shot to feed the team of hungry Eskimo dogs. Since the ice was packed solidly to the south, Larsen turned north along Cornwallis Island as far as Cape Airy, where he found leads pointing westward towards Bathurst Island, the south shore of which was obscured by a heavy snow-storm. Despite being turned and buffetted by the ice, the *St. Roch* maintained a forward course, and Cape Cockburn was reached about noon on August 23. Here solidly-packed floes blocked further progress. The tide set to the east, and the *St. Roch* was carried 20 miles back to Ackland Bay before anchoring close to shore. Larsen's difficulties were further increased by the failure of his magnetic compass, which had pointed fixedly at the bow of the schooner for several days. For the remainder of the voyage he had only his Admiralty charts and an amazing sense of direction upon which to depend as navigation aids. Even the sun was hidden by continuous snow-storms.

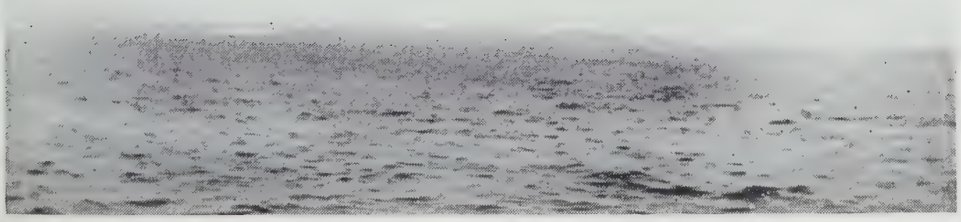
Early in the morning of August 24 the *St. Roch* once more slipped along the coast to Cape Cockburn and anchored, while a party went ashore to look for Captain Bernier's cairn. No trace of the cairn could be found, but numerous bear tracks in the area suggested that these curious animals might have scattered it. Larsen left an R.C.M.P. cairn near a conspicuous rock on the south side of the point and placed a record of their visit inside it for historical reference. From this high cape it could be seen that Viscount



Travelling up Navy Board Inlet after leaving Pond Inlet, N. Baffin Island. Photo by P. D. Baird

Melville Sound was filled with ice to the horizon. The ice was broken but tightly-packed, and was pushed against the islands by a strong south wind. Ice was also being carried southward by currents through Austin Channel, west of Bathurst Island.

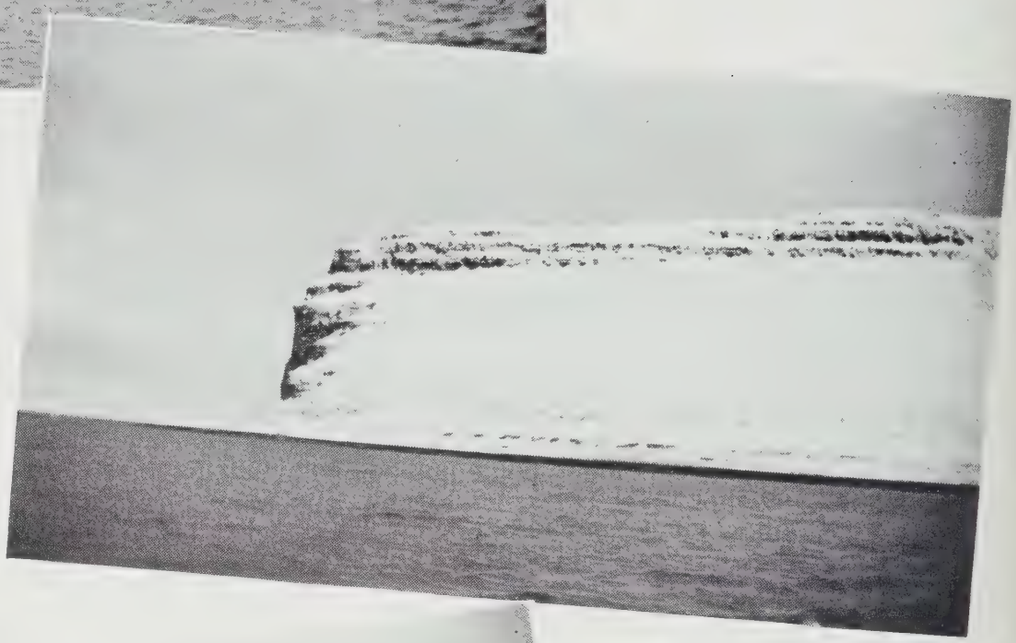
Since he could not proceed westward, Larsen decided to try a route north of Byam Martin Island. He experienced a great deal of trouble near Graham Moore Bay on western Bathurst Island, due to the *St. Roch* drifting southward with the current each time she was stopped by the ice. After patiently working back and forth from one small opening to another, shoving the floes when possible, or letting them drift by, the *St. Roch* made the north coast of Byam Martin Island on the afternoon of August 25. Here Corporal Hunt and a party went



Cape Bounty, Melville Island, on the 110th meridian. The British Admiralty offered a reward of £5,000 for the first passing of this point.



Approaching Beechey Island—historic Erebus Bay to right behind cliff.



The cairn and ruins at Beechey Island are on the foreland to the left below the cliff.



Ruins of Northumberland House, built 1852-54 by Commander Pullen, R.N.; note mast of yacht "Mary" stuck in sand. Erebus Bay in background



Cpl. Peters, Const. McKenzie and Const. Andreason standing beside Franklin Memorial Tablet on Beechey Island.



Cape Cockburn, Bathurst Island, looking northward (snow-covered in mid-August).

ashore to build a cairn and leave a record of the patrol. Because of a heavy snow-fall, no observation of the surrounding land could be made, but fresh caribou tracks were seen.

August 26 began with clear weather and a fresh westerly wind. After rounding the northern tip of Byam Martin Island, the expedition found open water to the westward. Melville Island was soon sighted, near Consett Head, and the men saw a herd of twelve musk-oxen grazing on the grassy lowland. Other herds of musk-oxen were seen on the tundra farther south, proving that these protected animals, part of the remnant of the species, had survived on their isolated sanctuary. Except for a long patrol by the late Inspector Ernest Joy of the R.C.M.P. to the island in 1929, no white man has visited Melville Island since Stefansson's party in 1917.

South of Griffith Point, Melville Island, where a cairn was built, the *St. Roch* was forced to travel slowly, due to shoal water of 4 to 8 fathoms for 2 miles off the coast. At midnight the expedition anchored off Palmer Point, with still no ice in sight, and another record was deposited. An excellent harbour north of the point was examined the following morning, when thick weather discouraged further sailing. At noon on August 27 the weather cleared, and they approached Dealey Island, where the huge cairn, topped by three barrels on a post, could be seen for miles at sea. The party went ashore and examined the large cache left by Captain Kellett of the H.M.S. *Resolute* in 1852-53. The walls of the cache were still standing, but there was no roof and most of the contents had been destroyed by the weather and marauding bears. The skeletons of two bears found near by suggested that they might have been poisoned by consuming some of the spoiled food. Some of the barrels contained clothing, sea-boots, flour, chocolate, peas, beans, and tea; all were in a soggy, rotten condition. Some of the iron cans and tanks contained hard-tack and canned meats and vegetables, but most of them had been broken into and the contents had spoiled. On the beach close by the men found two broken rifles and a case of ammunition left by Captain Bernier in 1909.

They left Dealey Island on the morning of August 28, and travelled along the low coast to Winter Harbour, about 30 miles to the southwest. Winter Harbour was chosen by Captain Bernier as the winter quarters for his Canadian Government Expedition of 1908-09, and was visited again by him in 1910. The storehouse built by Bernier in 1910 was still in fair condition, although almost empty, and from a rafter hung a bottle containing the record left by Inspector



Approaching Dealey Island, off southern Melville Island; note seaman sounding with lead.



Cairn erected on Dealey Island by Capt. Kellett, H.M.S. "Resolute", 1852.

Joy who had last patrolled there in 1929. Numerous tracks of musk-oxen, caribou and wolves were noted around the harbour, but only one old bull musk-ox was seen.

After depositing a record at Parry Rock, Larsen and his crew left Winter Harbour on August 30 and had a clear run 30 miles to the south before meeting heavy ice. Due to mist and rain, they moored to a large floe to await visibility and replenished their fresh-water tanks from pools on the ice. Early the following morning they began working their way through the heaviest ice yet encountered, as it pushed eastward from the Arctic Ocean through M'Clure Strait. Several times heavy fog, which obscured leads, prevented progress, and they were gripped by the general counter-clockwise revolving motion of the churning, growling ice. Soundings of 50 and 63 fathoms were obtained during the crossing of the strait. They drifted throughout September 1, but towards evening of September 2, after they had worked forward again, the fog lifted and a cape loomed ahead. Larsen did not know which coast of Prince of Wales Strait the cape marked, but decided to turn eastward. The cape proved to be Peel Point, and he soon realized that he was in Richard Collinson Inlet. Since there was much ice in the inlet and more pouring in behind the boat, Larsen did not consider it wise to explore the inlet to its head, and so turned around and retraced his course to Peel Point.

The *St. Roch* entered Prince of Wales Strait on September 3 in bright, clear weather. No ice blocked the passage and good time was made to the southward. Holman Island was reached in mid-afternoon of September 4, and the exciting news that the vessel had come through the Northwest Passage was given to the amazed Hudson's Bay Company manager. Although many explorers had spent years in unsuccessfully trying to work through the eastward-moving ice, it had taken Larsen and the *St. Roch* only eighteen days from the time they entered Lancaster Sound until they were

Large cache built by Capt. Kellett, 1852, to hold supplies for future expeditions; note empty tins left by Kellett's expedition.



Inside of Kellett's cache on Dealey Island—most of contents now destroyed.



at Holman Island in the Western Arctic.

Larsen received instructions from Ottawa to proceed outside to Vancouver and to complete the coast-to-coast voyage if he could. After he left Holman Island on September 5, heavy ice gave difficulty all across Amundsen Gulf and forced the *St. Roch* to proceed slowly close to the shallow shore of the Canadian mainland west of Cape Parry. On September 8 she was freed of the ice off the harbour at Port Brabant, but ran aground trying to enter it in the dark. Larsen backed her off and was able to get in just in time to ride out the worst storm ever known at this place. Two days later, when the storm abated, the entrance to the harbour was completely changed and Larsen erected new markers. The ice was packed solidly in Mackenzie Bay by the northerly hurricane, and it appeared that the *St. Roch* would have to winter at Port Brabant. On September 17, however, Larsen decided to attempt the crossing, and, after making slow progress through the heaviest ice seen during the voyage, successfully reached Herschel Island. The Eskimo family and dogs from Pond Inlet were left here, along with a large share of the *St. Roch's* coal and other supplies.

The history-making 'Mounties' left Herschel Island on September 21, as the harbour was beginning to freeze over, and met more heavy ice and fog along the Alaskan coast. With their goal so close, the cruel Arctic weather was teasing them by making their progress more and more difficult, but the *St. Roch* and her determined crew were not to be denied this time, and their experienced captain countered every aimless movement of the ice. The last of the polar pack was left behind near Wainwright Inlet, Alaska, and the remainder of the voyage became merely a matter of reaching port. Stops were made at King Island in Bering Sea and Akutan Harbour in the Aleutians.

After they left the Aleutian port on October 4, a violent two-day storm and heavy swells on the North Pacific provided but a fitting finish to an exciting historic voyage. Towards evening on October 16, the *St. Roch* came into Vancouver Harbour with all flags flying and a large white banner proclaiming the successful trip through the Northwest Passage. Three hundred and sixty-eight years after Martin Frobisher first attempted to enter the Arctic, seeking a northern route, the R.C.M.P. schooner *St. Roch* became the first ship to complete the Passage in a single year from east to west, with a total elapsed time of 86 days. As Captain Larsen expressed it: "We were lucky and had the breaks. No one can predict ice or navigation conditions in the Arctic. What we accomplished this year might be repeated the next, or it might be many years. Much would depend upon the type of vessel used, and the ice conditions of that particular year. Our voyage showed that the Northwest Passage can be traversed in a single year, but does not prove that this could be accomplished every year."



Arrival in Vancouver, B.C., after successfully traversing the Northwest Passage—for the first time in a single year.





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PHYSICAL GEOGRAPHY OF THE CANADIAN WESTERN ARCTIC

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embayment in the Precambrian rocks. The mainland coast from Boothia Peninsula to Darnley Bay, except for a sedimentary strip north of Coppermine and on Kent Peninsula, is composed of rugged or worn Precambrian rocks. East of Coppermine settlement granites and gneisses predominate. On the north side of this basin Precambrian rocks outcrop on the central west coast of Victoria Island and extend in a broad belt across the northern part of the Island to the heads of Richard Collinson Inlet and Hadley Bay, and possibly to the northeastern tip of Victoria Island. Within this basin, Precambrian sedimentary rocks and early Palæozoics, chiefly Ordovician in age, have been deposited.

The best known of the Precambrian rocks in the Western Arctic is the Coppermine Series. They outcrop on both sides of the Coppermine River and extend eastward. The rocks have a gentle dip towards the north. Northeast of Great Bear Lake, they have been eroded into linear hills known as the Copper Mountains. These hills have steep, south-facing cliffs, and gentle northward slopes terminating in drift-filled valleys. The mountains are composed of a series of superimposed flows of basaltic lavas. A similar type of topography, unidentified as to age, is located 40 miles east of the junction of Coppermine and Hepburn Rivers. There the escarpments face eastward. North of Copper Mountains, Precambrian shale and limestone overlie the basalts of the Coppermine Series. Basaltic rocks of similar appearance outcrop again on southern Victoria Island at Richardson Island and west of Cambridge Bay, but they do not constitute the whole south coast of the Island.

Palæozoic rock, largely unclassified as to age, underlies the remainder of the Western Arctic Islands, and a mainland coastal section northwest of Coppermine. It is probable, however, that more recent rocks of Cenozoic age have been laid down in parts of Banks and northwest Victoria Islands. The detailed geology of much of the Western Arctic, particularly identification of the sedimentary rocks, is as yet imperfectly known.

Rocks of Ordovician age have been reported from the flat west coast of Boothia Peninsula and on part of low King William Island. Fossils found in rocks in other parts of King William Island indicate Silurian age. At Read, Liston and Sutton Islands, off the southwest coast of Victoria Island, Ordovician rocks appear again; probably similar rocks can be found on the nearby mainland. Younger rocks have been reported from both the south and north coasts of Banks Island suggesting that much of the Island may be considered post-Silurian in age.

Glaciation.—Although the southern limit of continental glaciation in North America is well established, there is much doubt about the northern boundary. Recent geological work has established the fact that at least the southern part of Victoria Island was glaciated, and possibly the whole Island.* The thickness of the ice over Cambridge Bay has been estimated to have been at least 2,000 feet. Evidence of glaciation is obtained from the distribution of erratics, and glacial striæ, especially glacial deposition, including eskers and moraines.

The last direction of movement of the ice can be interpreted by glacial striæ. These scratches in the rock surface of the mainland coast indicate that ice pushed to the northwest. On Victoria Island the recorded striæ point westward and southward suggesting a final centre of dispersal on the Island itself.

*Washburn, A. L. "Geology of Victoria Island and Adjacent Regions, Arctic Canada". Geological Society of America Memoir 22, 1947.

Since the melting of the ice-cap of glacial times, the whole Arctic has slowly risen out of the sea. This rise has been recorded by emergent beachlines containing fossil marine shells. In some places these gravel ridges are found as high as 500 to 600 feet above the present sea-level. Many of the present-day coasts, and especially the low coasts of sedimentary rock, are characterized by rows of ancient beachlines rising successively higher inland.

The slow emergence may still be continuing. At Cambridge Bay, a shoal reported by the explorer Collinson in 1852, is now a small islet above water. The rise, in this case, has amounted to about five feet in 100 years. Further evidence of deeper water in the Western Arctic is found in the ancient whalebone houses built by Eskimos around King William Island almost 1,000 years ago. The seas in that area are now too shallow for large whales.

Topography.—Topography in the Western Arctic is characterized by combinations of low, level, grassy plains and rounded, barren, rugged hills. There are no mountainous regions; even the rough hilly country does not exceed 2,000 feet in elevation. The highest elevations are found on western Victoria Island and southern Banks Island. The mainland coast from Yukon Territory to Boothia Peninsula is mainly low and flat, but elsewhere rises abruptly from the water to a height of a few hundred feet.

Along the Yukon coast a low tundra strip about 10 miles wide fronts the rugged Richardson and Buckland Ranges. Numerous small streams cross the rolling plain, and lakes dot its surface. The Mackenzie Delta region and the coast eastward to Baillie Island are very low and swampy. Innumerable small lakes, cut off from the sea by strips of beaches, cover the coastal regions, and shallows extend offshore. A sharp bluff rises along the east side of the Mackenzie Delta, beyond which many small conical hills, called "pingos", are found near Port Brabant (Tuktoyaktuk). The inland country to the west is gently rolling tundra, with numerous lakes filling the depressions in the permanently frozen ground.

The coast east of Baillie Island has steep bluffs rising about 200 feet above the water. The Smoking Mountains along the west side of Franklin Bay are steep hills of about 500 feet altitude. South of Darnley Bay, hills rise to about 1,000 feet and appear more rugged on the coastal side. These hills are actually the eroded front of the Precambrian plateau facing towards the sea: they have very little relief on the south side. The lake-dotted country inland from Horton and Anderson Rivers is a rolling tundra with few major topographic features.

Between Pearce Point and Stapylton Bay the coast is straight and in many places lined with low cliffs of 50 to 200 feet. In the low sections elevations increase inland in a series of terraces to a rolling interior plateau where altitudes average about 1,000 feet. Tundra vegetation of grasses, sedges and mosses is fairly abundant over the plateau. The coast around Bernard Harbour is flat, rising in series of former beachlines to a rolling grassy interior. Gravel beaches are the main topographic features.

Between Coppermine Settlement and Bathurst Inlet, the coast is more rugged than that to the westward. Rocky cliffs line the south coast of Coronation Gulf, except where broken by river mouths and valley plains. South of Coppermine settlement, the Copper Mountains are linear ranges of hills with south-facing cliffs. Much of the interior country south of the Copper Mountains and extending towards Burnside River consists of barren rocky ridges and drift-filled valleys. South of Burnside River the Peacock Hills, which have an altitude of about 2,000 feet, rise abruptly 500 to 1,000 feet above the rolling plain.

Around Bathurst Inlet rugged hills rise directly from the water, sometimes to over 1,000 feet elevation. The hills decrease in relief inland. Numerous rocky islands fill the Inlet and almost block its mouth. Their precipitous cliffs make a scenic setting of rugged grandeur.

Elevations decrease east of Bathurst Inlet as the rocky hills become lower and the grassy valleys widen. Kent Peninsula is generally low. Its shelving beaches rise from the shallow shores to low rocky hills in the interior. Higher hills of Precambrian rock form the neck of the peninsula, and numerous small rocky islands are sprinkled offshore to the east.

The south coast of Queen Maud Gulf is low and flat. Numerous islands and unmapped shoals are found in the shallow water offshore. The lowland is rocky near the shore and extends far inland in swampy, lake-covered tundra. Several long rivers, some of them entrenched, drain through the area towards the coast. The low divide between these streams and Back River is covered with glacial deposits forming low hills. Southeast of Perry River there is a hilly section consisting of rock ridges rising about 500 feet above the surrounding region. Streams with steep-sided valleys have cut into it. The extent of the hilly section is not known and details are scarce concerning the topography of the inland region.

The only features on low Adelaide Peninsula are disintegrated rock and gravel ridges which indicate ancient beachlines. A similar low coast extends eastward to the mouth of Murchison River. Little is known about the interior country other than the fact that rugged hills are found between Chantrey Inlet and Wager Bay.

East of Rae Strait and along the west coast of Boothia Peninsula as far north as the Tasmania Islands, shelving coasts marked by old beach terraces are common. The rugged Precambrian hills rise abruptly above this plain on the west side of central Boothia Peninsula and occupy the entire northern part of the peninsula north of Wrottesley Inlet. This rough region has barren rocky hills and ridges rising about 1,000 feet above lake-filled, narrow valleys. The west coast of Somerset Island is also rugged and has numerous high, steep, offshore islands.

The whole of King William Island is low. Near the coast the surface consists of broad terraces marking former beaches. Except for a small conical hill east of Gjoa Haven, and slightly higher land on the northwest corner, it is doubtful if any of the island exceeds 400 feet in altitude. Its surface is mantled with broken sedimentary rock and glacial deposits. Lakes fill the depressions above the permanently frozen ground. Shallow water extends offshore in most places, especially along the northeast coast.

Prince of Wales Island has three physiographic divisions. The southern third of the Island is low and flat and is covered with numerous small, shallow lakes. Vegetation is unusually sparse, with much of the exposed surface consisting of disintegrated, angular sedimentary rock in low, flat ridges or domes. Another flat plain is located on the northwest corner of the Island. The central part of the Island is a plateau of 500 to 1,000 feet altitude, which is deeply incised by numerous streams along the eastern side. There are very few lakes in this section, and many of the stream beds are broad, shallow, gravel-filled valleys. The red escarpment front of the plateau rises abruptly above a narrow lowland west of Browne Bay. The northeastern parts of the Island and the large rocky islands blocking the east side of Browne Bay are high and rugged, possibly reaching 2,000 feet altitude. This rugged section is probably caused by underlying Precambrian rocks which also appear on nearby northwestern Boothia Peninsula and western Somerset Island.

CANADA'S WESTERN ARCTIC

REGIONS ARCTIQUES OCCIDENTALES DU CANADA



The eastern half of Victoria Island is similar in appearance to King William Island. A low, flat coast rises inland in low, gravel ridges and flattened domes across lake-dotted country. Outstanding hills are only a few hundred feet high. One of the most notable, Mount Pelly, near Cambridge Bay, is 675 feet high, and probably consists of unconsolidated glacial material. The south coast is also low and shelving, except at Richardson Island where Precambrian rocks form low, rugged hills. The eastern interior is also low and is covered with innumerable circular, shallow lakes as far westward as the head of Prince Albert Sound.

Higher hills rise in western Victoria Island. Wollaston Peninsula, north of Dolphin and Union Strait, is rugged in places in the interior. Elevations of about 1,700 feet have been reported. The hills consist of irregular ridges of unconsolidated material. Elevations decrease towards Prince Albert Sound. North of the Sound, ridge and valley topography is characteristic. The broad linear valleys trend to the northeast, and are separated by rocky ridges, sometimes with perpendicular, columnar cliffs. Altitudes are probably about 1,000 feet, but may reach 2,000 feet south of the east end of Minto Inlet. Low hills surround Minto Inlet, and in some places form prominent headlands. Inland, north of the Inlet, a generally rolling plateau is rugged in places. In northwestern Victoria Island rocky hills are cut by many ravines. Wide valleys extend east-west, and are separated by ridges with south-facing escarpments. Lakes are not as numerous in this northwestern region.

The north coast of Victoria Island is only sketchily known. High and precipitous cliffs have been reported between Collinson Inlet and Hadley Bay. A line of higher hills rises inland to about 1,500 feet. Many small rocky islands are found offshore in the bays. The northeastern corner of the Island is a newly discovered separate large rocky island with elevations of about 1,000 feet.

Banks Island is generally high and rolling, being marked by high cliffs on both the south and north coasts. Highest elevations are found at the south where Nelson Head, the southern cape, rises a sheer 1,000 feet from the water. Rugged hills increase their altitudes inland to about 2,000 feet. The precipitous cliffs and hilly sections of the north coast rise about 600 feet above sea-level. The northern interior is rough and hilly.

The west side of Banks Island has a low flat coast. It slopes gradually inland to low rolling hills of about 1,000 feet altitude. The hills are separated by broad valleys with abundant grassy tundra vegetation. Numerous large rivers drain the interior to the west and north. The east coast is low in the central section, but is rocky and rugged towards the northeast. The northeast interior has less vegetation than central Banks Island. Several flat sandy areas have been reported there.

Climate.—There are only three meteorological stations in the Western Arctic* from which climatic records may be obtained. They are at Cambridge Bay, Coppermine and Holman Island. They indicate that the western part of the region, around Amundsen Gulf, is milder than the interior sections around Queen Maud Gulf. The region has an Arctic climate, which means that no month has an average mean temperature above 50°F. This 50° isotherm for the warmest month is generally found a short distance north of the tree-line.

Old records at the Herschel Island whaling station indicate that its warmest month is below 50°F., and it is, therefore, within the Arctic zone. The treeless,

* As defined on page 3.

tundra character of the vegetation of Herschel Island and the nearby mainland substantiates this Arctic characteristic.

Aklavik, in the Mackenzie River Delta, has two months when average mean temperatures are above 50°F. This places it in the Subarctic zone. The forested character of the country is further proof of its relatively mild summers. The Arctic line is found somewhere between Aklavik and the barren coast. Although not within the region, the Aklavik figures may be used as characteristic of the coast since there are no other meteorological stations along the western mainland of the Western Arctic. Actual temperatures at the coast would be somewhat lower than the Aklavik figures. East of the Mackenzie Delta the coast and the inland areas between rivers are treeless tundra. Forests finger north along the valleys of the Anderson and Horton Rivers, but do not reach the coast.

Coppermine settlement is in the zone between Arctic and Subarctic. The meteorological station there has an average of 50°F. for July, placing the Settlement on the line between the two climatic regions. Trees are found a short distance inland along the sheltered valley of the Coppermine River, indicating the warmth of the summer months.

Because of inaccessibility, no meteorological stations are located in the vast region of the Canadian mainland east of Coppermine, until Baker Lake and the west coast of Hudson Bay are reached. The tree-line trends away from the Arctic coast to the southeast. It is located north of the east end of Great Slave Lake and continues eastward to the Hudson Bay coast near Churchill. Exactly where the southern limit of the Arctic is in this area is not known, but it probably parallels the tree-line as it does in other regions where there are climatic records.

Summers may be described as cool in the Western Arctic. The four months of June to September have average mean monthly temperatures above 32°F. in the southern parts of the region. In July and early August, afternoon temperatures may rise above 60°F., and usually fall to around 40°F. in the evening. The day-by-day temperature at settlements may depend upon the direction of wind. A wind blowing from the warm land will be milder than a breeze from the cold waters of the Arctic gulfs. Temperatures seldom rise above 65°F. at Cambridge Bay and 70°F. at Holman Island. The absolute maximum recorded at both stations is 75°F. Occasionally during the summer, temperatures may reach almost 80°F. at Coppermine, and the maximum recorded is 87°F.

The change from autumn to winter is very rapid during early October. During that month the lakes and harbours have frozen over and the length of the period of daylight has decreased rapidly. Average mean monthly temperatures drop below zero in November and remain below zero for 5 months at Coppermine, Holman Island and Aklavik, and for 6 months at Cambridge Bay.

February is the coldest month at each of the three Western Arctic weather stations. The monthly mean of −27°F. at Cambridge Bay is one of the coldest known in Canada, being exceeded only slightly by records from stations on northern Baffin Island. Winters, which average between −15°F. and −20°F. during January and February, are not as cold at Coppermine, Holman Island and Aklavik.

Minimum temperatures do not drop as low in the Western Arctic as in the Mackenzie Valley. Holman Island, located on Amundsen Gulf which may occasionally have open water between ice floes, has a usual winter minimum of about −37°F.

Lower temperatures are often recorded by settlements in northern Ontario and on the Prairies. The lowest temperature ever recorded at Holman Island is −45°F. Coppermine is colder, having a mean winter minimum of −48°F., and a record minimum of −54°F. Cambridge Bay has the lowest minimum temperatures known in the whole Canadian Arctic. Nearly every winter readings in the Arctic of about −54°F. are observed, and the lowest recording reported is −63°F. from there.

In April, monthly mean temperatures rise to slightly above zero at all stations except Cambridge Bay. Spring comes quickly as the days become longer in May. Average monthly mean temperatures jump 20 degrees between April and May. The snow begins to melt from southern slopes about mid-May on the mainland. Summer begins in July when the ice breaks up along the coasts and in the lakes.

Since most of the Western Arctic settlements are in the vicinity of latitude 69°N., they have about the same duration of daylight and darkness. In summer there are 24 hours of light from the latter part of May to the end of July. During this time the sun circles low in the sky, dipping down towards the horizon in the north. By the end of July the sun is setting for a short period in the north. The period of darkness lengthens each day thereafter.

By the first of December the sun no longer rises above the horizon to the south. For the next month there is a period of twilight darkness, brightened by the light of the stars and moon, a twilight glow on the southern horizon, and reflections from the snow. Early in January the sun again peeps above the horizon, and each day thereafter the daylight lasts longer until there is equal day and night on March 21.

Precipitation is not heavy in the Western Arctic. About 10 inches are recorded at Coppermine and Aklavik, half of which falls as rain during the four warmest months. Six and seven inches are recorded by the stations at Cambridge Bay and Holman Island respectively, about one-third of which is rain coming chiefly in July and August. At Coppermine, three inches is the most rain ever recorded in one month, and in dry summers as little as one-half inch has fallen in a month.

Snowfall is difficult to record accurately at all Arctic stations because of the excessive drifting. From 40 to 50 inches is the usual amount which falls during the winter. Northern snow is generally hard and finely crystalline, especially when on the ground. It packs solidly, and where it collects to sufficient depths in depressions or on the sea-ice, can be cut into snow blocks for igloo-building.

Heaviest snowfalls come in October and November, but continue intermittently throughout 10 months of the year. Although a small amount of snow falls, the low winter temperatures and lack of sunlight prevent melting. In rocky, hilly country the ridge tops are often blown free of snow, but a snow cover, which is used for sledge-dog transportation, always remains throughout the winter in the valleys and over the lowlands and sea-ice.

Fog is most frequent during spring and summer months, especially near the coast. When warming air from the land comes in contact with ice-covered or cold seas, condensation occurs and fogs roll out to sea. Fogs are not as frequent a transportation hazard in the Western Arctic, however, as they are in Hudson Strait of the Eastern Arctic. Cambridge Bay and Coppermine average two to three days of fog each month during May, July and August. A maximum in May of eight foggy days at Coppermine and of nine at Cambridge Bay is the greatest number ever reported in one month.

Fogs are rare in the winter months when sea-ice and snow-covered land have about the same temperatures. Visibility is sometimes poor in this season, however, owing to drifting snow. During these "blizzards" all movement ceases, as Eskimo and white travellers wait in snow-houses or in tents for the storm to blow over. On the other hand, many days of spring are clear and bright, with scattered high clouds. This is the best time for travelling provided snow-goggles are worn as a precaution against snow blindness.

Winds blow predominantly from the northwest during the winter at most stations. At Coppermine, however, southwesterly winds are more common in the winter. In summer, winds from the east or northeast occur more frequently in the Western Arctic, but again shift to the northwest in autumn. Calms are more usual in winter than in summer.

Ice Conditions.—As in all Arctic regions, one of the main problems of accessibility is unpredictable ice conditions. For about 9 to 10 months coasts are closed to sea transportation by land-fast ice, and the open gulfs off Beaufort Sea are jammed with heavy ice floes from the shifting pack of the Arctic Ocean. During the short open season, when the ice moves off from the shores of the open coast, and melts in the enclosed seas, navigation is possible. The length of that season, and the degree of accessibility, however, vary greatly from year to year.

Early in September the lakes in the northern parts of the region begin to freeze over; by the end of the month small lakes on the mainland also have an ice-covering. Towards the end of September or early October ice forms across the harbours and inlets, and starts to build out from the shore. By the end of November or early in December, Coronation and Queen Maud Gulfs, and the connecting straits off the mainland coast, are frozen over completely except where there are unusually strong currents. If freeze-up comes during a period of calm, the ice will be hard and level, making an excellent winter highway. If the freeze-up period is stormy, and the ice is broken up several times before finally setting, the resulting ice-cover will be rough and hummocky.

One of the notable differences between Eastern and Western Arctic winter ice is the lack of a "tidal hinge" in the western region. Tides are quite minor in the Western Arctic, averaging from one to two feet on the open coast. In summer the height of the tide is influenced more by prevailing winds than any other factor. In the Eastern Arctic, high tides raise and lower the harbour ice, leaving a zone of weakened ice or open water between the main mass and the shore. In the Western Arctic, on the other hand, tides are so minor that the harbour ice freezes solidly to the shore. Its average thickness in late winter is five to seven feet.

In spring the ice breaks up first along the coasts, especially near the mouths of rivers. A strip of open water melts along the shore, and cracks appear in the harbour ice. Soon the cracks grow wider, and the floes are shifted about with the wind. Finally, a strong off-shore wind will move the ice out of the harbour into the shifting mass in the main channels. This harbour break-up occurs in the last half of June or early July along the mainland coast, but may be as late as the middle of July among the Western Arctic Islands.

Similarly, small lakes on the mainland begin to break up towards the end of June, and larger lakes are ice-free by the middle of July. On northern Victoria and Banks Islands, large lakes may still be frozen over early in August.

After the harbour ice has moved out there still remains a period of weeks before navigation is possible along the coasts. The open coast of Beaufort Sea near the Mackenzie River Delta and that south of Amundsen Gulf usually have a strip of open water along the shore by early August. At any time during the summer, however, strong northerly winds may push the heavy floes of Beaufort Sea southward against the coast. Westerly winds may block the harbours and inlets of western Victoria Island throughout July, and may jam Dolphin and Union Strait. In some years this latter Strait has been blocked with ice floes throughout the summer, but this barrier is not common.

By the end of July, Coronation Gulf usually has enough open water for navigation. The floes move about with the winds in the central part of the gulf until they melt. In shallow Queen Maud Gulf the ice remains until the latter part of August before melting away. At any time heavy polar ice from M'Clintock Channel may push southward through Victoria Strait and into Queen Maud Gulf. Simpson Strait, south of King William Island, is too narrow for polar ice to enter so that this strait and the straits to the eastward are open in August.

North of King William Island there is almost no ice-free season, or at best a period of only a few weeks around the first of September. Heavy polar ice from M'Clintock Channel pushes southward throughout the year, and having no outlet, jams into the passages of Victoria, James Ross and Franklin Straits. Only occasional navigation by shallow-draught vessels has been possible off the west coast of Boothia Peninsula, particularly when favourable winds hold the ice off the coast. Peel Channel apparently has pack ice throughout the year, but in some seasons it is loose enough to permit schooner navigation with difficulty.

North of Banks and Victoria Islands heavy polar ice from the Arctic Ocean packs the channels throughout the year and pushes against the coasts. It is possible that the ice loosens slightly by the end of August, but navigation will always be hazardous. Prince of Wales Strait, between Banks and Victoria Islands, has been reported open in late August in some years, and jammed full of floes in other years.

Summary.—The Western Arctic is a treeless region along the north-central and northwestern coast of the mainland of Canada and includes the nearby Arctic Islands. It is underlain chiefly by ancient worn Precambrian rocks on the mainland, whereas sedimentary rock predominates on the islands. Most coasts are characterized by old gravel and disintegrated rock beach-lines which indicate the emergence of the region from the sea since the last Glacial Age. Topography, often dependent on the underlying bedrock, is either rough and rugged in places, or low and flat. Most of the region, owing to the permanently frozen subsoil, is covered with innumerable lakes of all sizes and shapes.

The region has an Arctic climate, in which winters are continuously cold for five or six months, but do not record the extreme minima of the nearby Subarctic Mackenzie Valley. Summers are cool and short in the Western Arctic. Afternoon temperatures occasionally rise above 60°F., and no month has an average mean temperature above 50°F. Precipitation is low throughout the year. Rains fall in July and August, and snowfall is most frequent in October and November.

The seas and straits off the mainland and between the Arctic Islands are frozen over for about nine months of the year. The ice begins breaking up in July along the mainland, the exact time of break-up varying regionally and from season to season. The wide channels north of the Western Arctic Islands remain jammed throughout the year with heavy pack-ice from the Arctic Ocean.

Canada's Western Arctic



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Eskimos leaving a spring sealing camp on the sea-ice near Coppermine.

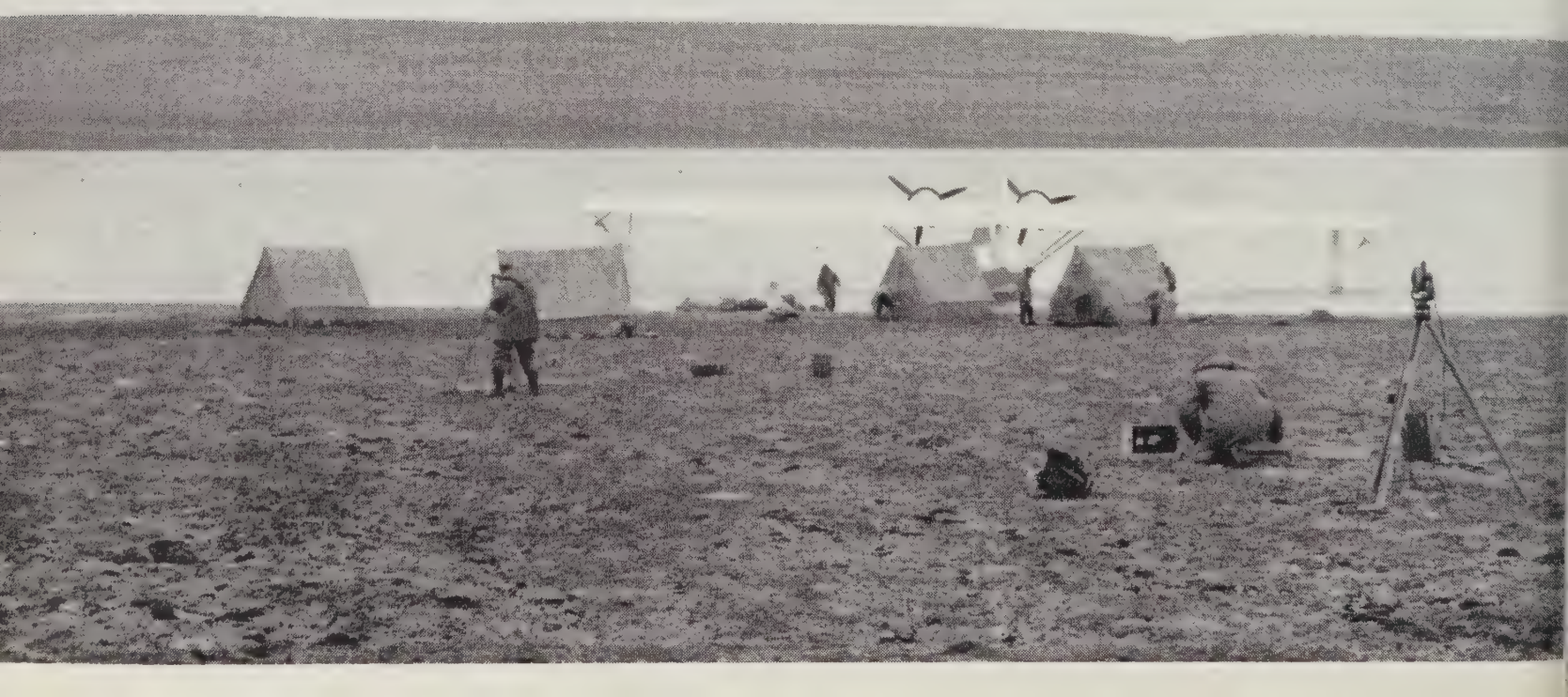
Canada's Western Arctic

by J. LEWIS ROBINSON

CANADA HAS VAST Arctic regions, comprising almost one-third of her area. Physical conditions and human adaptations vary sufficiently within this area to indicate a division into three sub-regions. The Eastern Arctic is best known. It is approached from the Atlantic Ocean or Hudson Bay. The Far Northern Arctic Islands, lying north of the wide channels between Lancaster Sound and M'Clure Strait, are separated from the Arctic Islands to the south of them. Because of their inaccessibility and lack of inhabitants they are being considered as a separate region. The Western Arctic, which has little contact with the other Arctic regions mentioned, is a sparsely populated section, only recently settled by whites.

Magnetic Pole survey party setting up camp on the tundra around a lake on northeastern Prince of Wales Island, August 1947.

J. L. Robinson



The Western Arctic comprises the southwestern Arctic Islands and that part of the mainland of northwestern Canada lying north of the tree-line. The region includes a narrow strip of the coast of Yukon Territory and offshore Herschel Island, the mainland tundra coast of northern Mackenzie District east of the Mackenzie River delta, and the northern coast of Keewatin District as far eastward as Boothia Peninsula and the 95th meridian. The islands included in the Western Arctic region are Banks, Victoria, King William, and Prince of Wales.

This rectangular region is a treeless Arctic territory. Its physical appearance is similar to that of many parts of the larger Eastern Arctic which forms the northeastern fifth of Canada, but it is differentiated from the latter by method of entry. Transportation lines, supplies, and communication in the Western Arctic come generally from the south and west. There is very little intercourse between the two southern Arctic regions. The Western Arctic is also differentiated from the nearby sub-Arctic and forested Mackenzie Valley, which, in the Northwest Territories, extends from Fort Smith to Aklavik. The physical character and problems of the Mackenzie Valley are quite different from those of the Western Arctic.

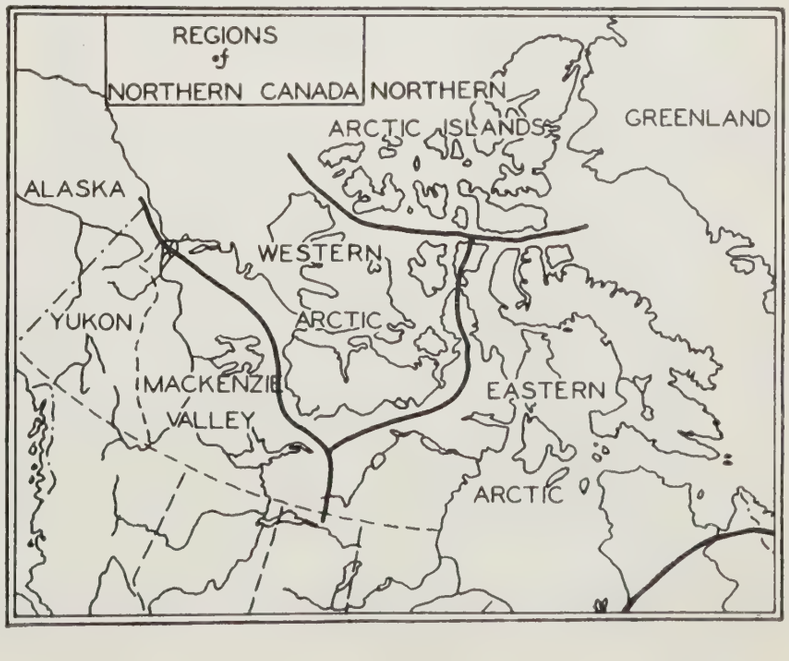
There are contrasts within the Western Arctic region. The northern parts of the islands are uninhabited by whites or Eskimos; the Arctic mainland and southern sections of the islands have a thinly scattered population of migratory Eskimos and a few white settlements. The Eskimos who live near the delta of Mackenzie River differ greatly in culture and equipment from the primitive natives of Boothia Peninsula and Back River. Transportation difficulties and facilities vary throughout the region. Transportation problems encountered along the open coast of Beaufort Sea and in Amundsen Gulf are different from those met in the almost-enclosed seas of Coronation Gulf and Queen Maud Gulf. Still different transportation difficulties and ice conditions are met in the eastern part of the region north of King William Island. These contrasts illustrate the diversities within a region which has geographical unity.

History

The region was first entered by Samuel Hearne in 1771, when he travelled overland from Churchill, Manitoba, to the mouth of Coppermine River. He was led by Indians who had been using native copper found in the area. No further exploration was carried on until 1821 when John Franklin and a party of British naval officers descended the rapids of Coppermine River, and explored eastward along the coast. Franklin's second expedition in 1826 mapped the western part of the mainland coast from the Mackenzie River Delta to the mouth of Coppermine River. The remainder of the Western Arctic mainland coast was defined by Thomas Simpson in 1838-39 when he proceeded eastward along the coast to beyond Chantrey Inlet.(1)

The Western Arctic islands were placed on the maps only about a century ago. Part of King William and Boothia Peninsula were mapped by James Ross in 1831. Sections of the southern coasts of King William and Victoria Islands were first travelled by Simpson on his return trip in 1839. The impetus to exploration came after 1845 in the search for Sir John Franklin's lost naval expedition. One of the searchers, John Rae, who also made notable trips in the Eastern Arctic, covered the whole south coast of Victoria Island for the first time in 1851.

(1) M. J. and J. L. Robinson, Exploration and Settlement of Mackenzie District, N.W.T.—*Canadian Geographical Journal* June-July, 1946.





The coasts of Banks Island and western Victoria Island were mapped by the expedition under Richard Collinson in 1850-54. Collinson, in H.M.S. *Enterprise* explored much of the region north and west of Amundsen Gulf, and penetrated to the north end of Prince of Wales Strait between Victoria and Banks Islands. His lieutenant, R. M'Clure, in H.M.S. *Investigator* rounded the western coast of Banks Island and finally abandoned his ship after spending two winters ice-bound in Mercy Bay, northern Banks Island. The coast of northwestern Victoria Island was followed by sledge parties under R. J. Wynniatt in 1851.

These explorations sketched in the major land masses of the Western Arctic. For 50 years, however, the northeastern and eastern coasts of Victoria Island remained unknown and unvisited. In 1905, G. Hansen from the Amundsen magnetic expedition wintering on King William Island, travelled northward by sledge, exploring about 200 miles of the east coast of Victoria Island. Finally during the winter of 1915, the north coast was mapped by S. Storkerson of the Canadian Arctic Expedition. For years a 100-mile stretch of the northeastern coast remained unseen by the white man. It was finally sketched by officers of the Royal Canadian Air Force in 1946, and proved to be a large island. No ship has ever navigated along either the north or northeast coasts of Victoria Island, and M'Clure's vessel was the only large one to pass along the west and north coasts of Banks Island.

The northwestern coast of Prince of Wales Island was mapped by British explorers E. Ommanney and S. Osborne in the spring of 1851. At the same time a subsidiary party under W. Browne explored the northeastern coast. Captain W. Kennedy, who was also searching for Franklin in 1851-52, was the only man to cross the interior of the island. The southern coasts were mapped by A. Young, of L. M'Clintock's expedition, in 1859. Except for occasional visits by Eskimos to the southeast

coast in recent years, the island remained unvisited and little known. Its interior was described and the coasts more accurately mapped during the summer of 1947 by a joint aerial expedition of the Royal Canadian Air Force and the Department of Mines and Resources.

The first white residents in the Western Arctic were whalers who began wintering at Herschel Island in 1890. Early in the present century they were operating in Beaufort Sea from a second base at Baillie Island. Some of the whalers carried on trading activities with the Eskimos, and before long other traders were established in the Western Arctic. The first recorded trading post was operating on Victoria Island in 1906, and a second one was opened in 1911 at Bernard Harbour, on the nearby mainland.

The Hudson's Bay Company and independent traders penetrated eastward into primitive Eskimo country. By 1920 there were several trading posts operating in the Coronation Gulf area. During the next decade traders extended their operations farther into the interior of the region, establishing posts along the south coast of Queen Maud Gulf, and on King William Island. During the same period (1920-30) police detachments and mission churches were opened at most of the posts. These additions gave an atmosphere of permanence to the settlements. This eastward migration of post settlements illustrates how recent is permanent contact of the Eskimo with Europeans.

The period 1930-40 was one of withdrawal. The region had too many trading posts for the few Eskimos living there. Many posts were closed or abandoned, particularly those of independent traders. At the present time there are only three major settlements in the Western Arctic, namely at Coppermine, Cambridge Bay, and Tuktoyaktuk. Smaller centres are occupied at Burnside Harbour, Read Island, and Holman Island. Mission stations are located at Stanton and Paulatuk. Trading outposts operate at Perry River and Gjoa Haven.

Geology and Topography

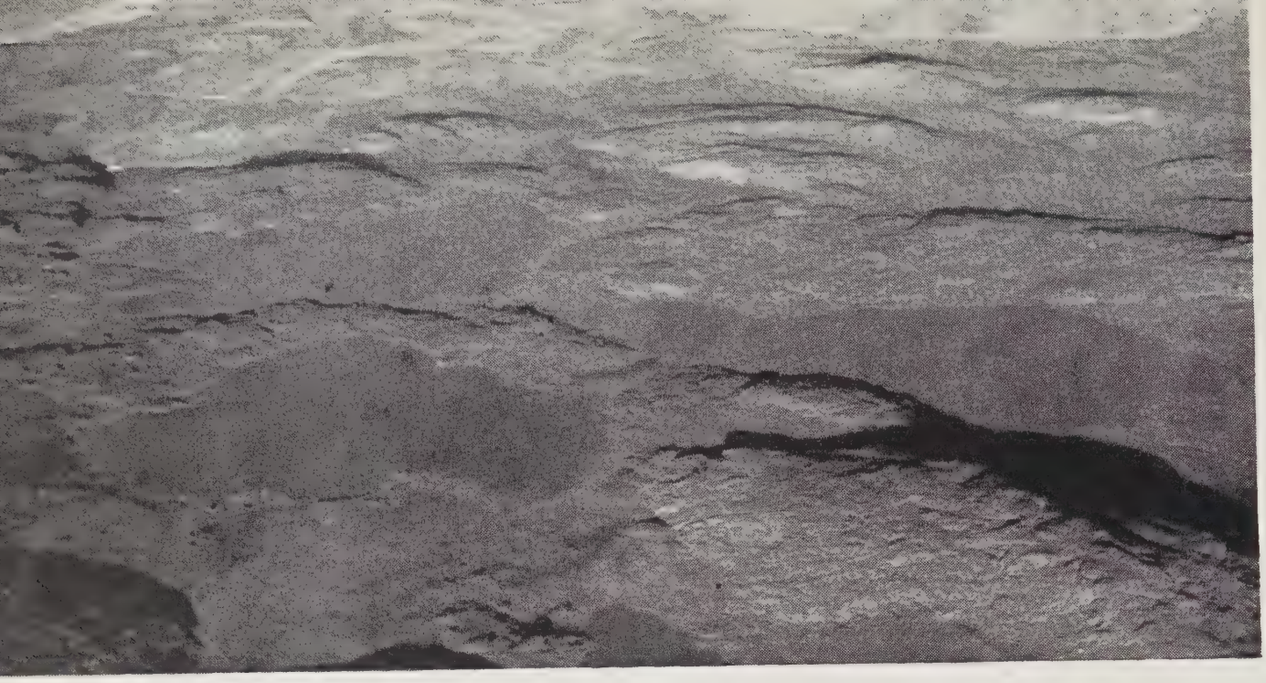
Topographic features in the Western Arctic are largely controlled by the geological structure and composition of the underlying rocks. The areas of Precambrian rock generally have rough and locally rugged topography. The lowlands and plains are developed over sedimentary rocks. The prevalence of raised beach terraces along most of the Arctic coasts is a result of recent geological events.

On the Western Arctic mainland there are very few outstanding topographic features. The coast of Yukon Territory is a narrow lowland about ten miles in width fronting the abruptly-rising Richardson and British Ranges. Numerous entrenched streams cut across the lake-dotted plain. East of the Mackenzie delta the coast is very low and swampy. Many small, linear lakes have been cut off from the sea by former beaches. The inland country is a rolling plain with so many lakes that there is almost as much water as land.

The coast east of Baillie Island has steep bluffs rising about 200 feet directly from the water. The Smoking Mountains, so-called because of burning coal seams, are abrupt hills of about 500 feet altitude west of Franklin Bay. The little known country inland between Anderson and Horton Rivers is a rolling tundra plain, well covered with small lakes.

The coast between Pearce Point and Coppermine is of two types. Some parts are low, steep walls of rock rising 50 to 200 feet from the water, whereas other sections are sloping lowlands marked with the parallel ridges of former beach-lines. Elevations increase inland to an interior plateau of about 1,000 feet.

Like all northern regions, the Arctic mainland is underlain by permanently frozen sub-soil. During summer this frozen layer melts for about a foot in depth beneath the tundra cover Since there is no underground drainage the water collects in every low depression, forming shallow, irregularly-shaped lakes. The mainland east of Coppermine River is literally covered with these in-



Typical barren, rock country on the Arcti mainland of Canad northeast of Coppe mine River.

numerable lakes. Separating the lakes are low, rounded ridges of Precambrian rock, or low, flattened domes well-covered with tundra vegetation. An occasional long twisting esker is a reminder of the denuding action over this region during the Ice Age.

A few ranges of hills rise above the general plateau level of the Canadian Shield. South of Coppermine settlement the Copper and September Mountains are linear ranges of about 2,000 feet altitude. The mountains have distinctive south-facing escarpments, separated by narrow, drift-filled valleys. The ridges are composed of a series of superimposed flows of basaltic lavas which have not weathered as rapidly as the softer rock in the valleys. Similar rocky ridges are found above the plateau northeast of Point Lake, on the Coppermine River. Farther to the east, near the headwaters of Burnside River, the Peacock Hills are sharp-pointed ridges rising about 1,000 feet above the rolling tundra.

Bathurst Inlet is one of the most scenic regions in the Western Arctic. The long inlet extends 130 miles into the rugged Canadian Shield, and is lined with steep hills rising about 1,000 feet directly from deep water. Numerous large and small rocky islands are scattered across the inlet. Picturesque harbours and coves are half-hidden behind narrow openings in the rocky coast.

Elevations decrease east of Bathurst Inlet. The rocky Precambrian hills become lower; the grassy valleys widen; countless lakes continue to be characteristic. Kent Peninsula is a lowland, underlain by flat-lying sedimentary rock. Another lowland, with few known outcrops, extends south of Queen Maud Gulf to Precambrian rock ridges near Back River. The same type of low, flat coast continues through Adelaide Peninsula and around to western Boothia Peninsula. Shallow water and numerous islands offshore make boat travel difficult along this coast in summer, and swampy, lake-covered land discourages movement on foot. In winter the flat land and sea-ice merge together to form a broad, snow-covered plain, ideal for travel by dog-team and sledge.

Boothia Peninsula rises abruptly above the level tundra plain, along the west coast, to rocky ridges which trend north-south. Narrow, linear valleys separate the hills.



Panorama of lowland topography near Cambridge Bay. The surface is covered with disintegrated slabs of sedimentary rock, and has only scattered bits of vegetation. Mount Pelly, in the distance to the left, is the only topographic feature above the lowland of southeastern Victoria Island.

Photographs by J. L. Robinson



vland tundra cover low bushes, shrubs, sses and moss on island in Point ke, Coppermine er.

The same rugged topography continues northward along the west coast of Somerset Island. Precambrian rock forms the high hills on northeastern Prince of Wales Island, and constitutes the rocky islands off the east coast.

The Western Arctic islands have both lowlands and plateaux. The lowland basin rimming the eastern end of the region extends offshore to include all of King William Island, southern Prince of Wales Island, and eastern and southern Victoria Island. The lowland, measured by geological time, has recently emerged from the sea. All the coasts are marked by beach-lines which record the comparative length of the emergence. The gravel beaches are the chief topographic characteristic of the water-soaked lowland. A few isolated hills of 300 to 600 feet, such as flat-topped Mount Pelly near Cambridge Bay, are outstanding features.

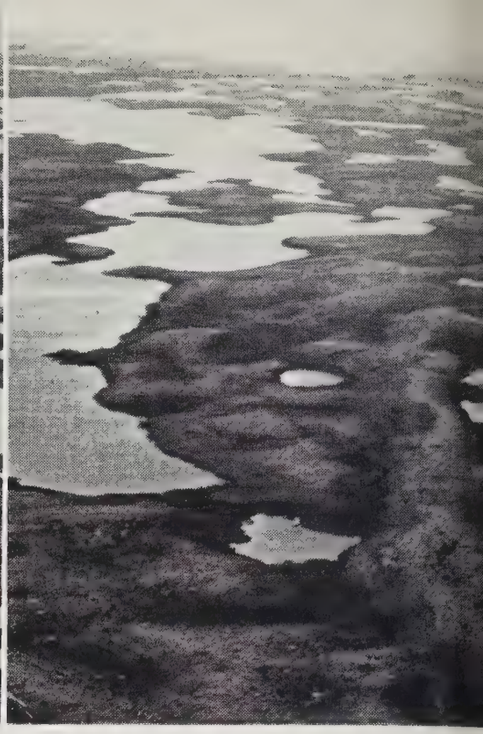
Western and northern Victoria Island, northern Prince of Wales Island, and most of Banks Island are plateaux or hilly. Highest elevations reach only to about 2,000 feet. Western Victoria Island, north of Prince Albert Sound, has a Precambrian base similar to that forming the ridge and valley topography of the Copper Mountains on the mainland. The geology of Banks Island is known only sketchily, but the central grassy plateau may be of younger rock, possibly post-Silurian in age. The western part of the island is a sloping tundra lowland crossed by many large and long rivers.

The topographic character of the Western Arctic has resulted in certain human and animal adaptations. The level or rolling Canadian Shield of the mainland is covered with ample vegetation which supports thousands of Barren Ground caribou. The presence of these large animals has enabled





The former beach-lines around the slopes of Mount Pelly (650 feet), Victoria Island, record the emergence of this area since glacial times.



Typical lake-covered l Western Arctic. A modif Bay

several hundred Eskimo to live in the region, roaming over the tundra in search of game and fur. The lowlands of the islands in the eastern part are not as adequately covered with vegetation—in fact, southern and central Prince of Wales Island is barren. Caribou are seldom found on these islands. They are, therefore, either uninhabited or the resident natives obtain their food from the sea. The rough, hilly regions are usually barren rock. Since there is little native game, they are seldom visited.

Climate

The Western Arctic is continuously cold throughout the winter.(2) The coldest section, and probably one of the coldest parts of Canada on a monthly average, is the area east of, and including, Cambridge Bay. The average monthly mean temperature for February, the coldest month, is -27°F. Somewhat "milder" temperatures are recorded around the coasts of Amundsen Gulf, which occasionally has open water between the ice floes. February averages are around -15°F. Monthly temperatures remain below zero degrees for five or six months of the year at all stations.

Although the Western Arctic remains cold throughout the long winter, it does not record the extreme minimum temperatures

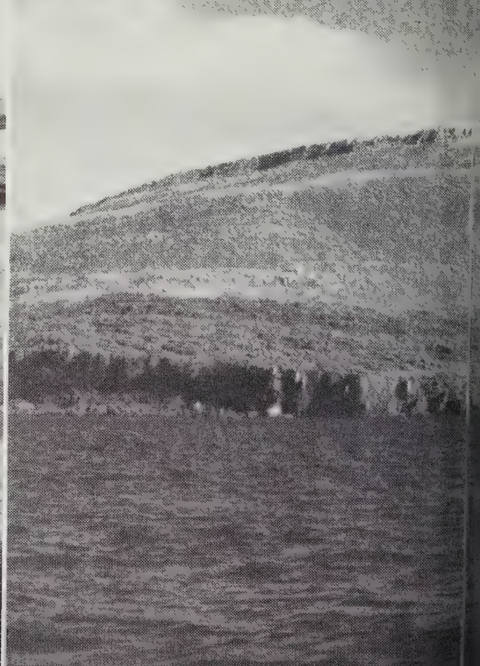
(2) See Weather and Climate of the Northwest Territories by J. L. Robinson, *Canadian Geographical Journal*, March, 1946.

Aerial view of the mountainous topography of Wollaston Peninsula, southwestern Victoria Island. The bare, rocky hills rise to elevations of about 2,000 feet.

A. L. Washburn

The rugged coast of Mint by columnar structure in t by weathered rock wh







e frozen ground of the hes towards Cambridge



A. L. Washburn

Aerial view of the distinctive polygon structure which develops in the tundra cover of the Western Arctic, southwestern Victoria Island.

which are known in the interior land mass of northwestern Canada. The usual winter minimum at Holman Island, on Amundsen Gulf, is -37°F and the lowest ever recorded is -45°F. Much lower temperatures are known in the Mackenzie Valley, Yukon, northern Prairies, and northern Ontario and Quebec. The latter regions, however, also have warm "spells" which are rare in the Western Arctic.

Coppermine, to the east of Holman Island, and farther into the interior of Canada, can be colder in winter. The average winter minimum is -48°F, and the record low is -54°F. Cambridge Bay has the lowest minimum temperatures known in the Canadian Arctic. Nearly every winter readings of -54°F are recorded and the extreme minimum was -63°F. Even these temperatures are not as low, however, as the -70°F of northern Alberta, -79°F of Mackenzie Valley, and -81°F of western Yukon.

Since most of the Western Arctic settlements are located at about 69 degrees North latitude they have about one month of 24-hour darkness during the winter. Even this darkness is brightened by a twilight glow on the southern horizon, reflections from the snow, and light from the stars and moon. Conversely, there are 24 hours of

Victoria Island, formed talus slopes are formed off from the cliffs.

A. L. Washburn

The red sandstone escarpment which rises abruptly above a narrow lowland along the west side of Browne Bay, eastern Prince of Wales Island. The plateau is about 500 feet above sea level.

J. L. Robinson







Winter conditions at Terror Bay, southwestern King William Island. Snowfall is not heavy, and strong winds over the lowland result in snow dunes forming on the sea-ice.

A. L. Washburn

daylight from the latter part of May to the end of July. During this time the sun circles low in the sky, dipping down towards the northern horizon.

Spring comes quickly in May when the days lengthen. Snow melts from southern slopes on the mainland. Average monthly mean temperatures jump 20 degrees between April and May. Summer begins in July when the ice breaks up along the coasts and in the lakes.

Monthly mean temperatures do not rise above 50°F. anywhere in the Arctic. In the Western Arctic during July and early August afternoon temperatures may rise above 60°F, and drop to about 40°F during the low sun period, or evening. The extreme maximum recorded at Holman Island and Cambridge Bay is 75°F. Coppermine, which occasionally receives warm air masses from the mainland in summer, has recorded an extreme temperature of 87°F. This is the highest temperature ever recorded in the Canadian Arctic, but is not characteristic.

As in all northern regions, precipitation is not heavy in the Western Arctic. About 10 inches are recorded annually on the western mainland stations, half of which falls as rain during the four warmest months. About seven inches of precipitation are recorded at the Arctic Islands stations, one-third of which comes as rain during July and August. The remaining precipitation is snowfall, which, however, is very difficult to record accurately in the Arctic because of frequent drifting.

These climatic characteristics indicate that climate greatly limits occupations in the Arctic. Because of cool summer temperatures there is no possibility of normal agriculture in the region. For the same reason, trees do not grow and there can be no forestry. The Eskimos have adapted themselves to the continuous cold temperatures of winter by wearing warm, fur clothing, made from the skins of native animals, and by living in dome-shaped snowhouses, made from the ample surrounding snow cover. White men who come into the region to live have to import lumber for their homes, and most of their food. Climate thus places a high cost factor upon any white settlement.

Ice Conditions

Typical of other Arctic regions, one of the main problems of accessibility in the Western Arctic is combatting unpredictable ice conditions. For nine to ten months the coasts are ice-bound with land-fast ice, and the open gulfs off Beaufort Sea are jammed with heavy pack-ice from the shifting mass in the Arctic Ocean. Navigation is possible during the short open season when the ice moves away from the open coasts, and melts in the enclosed seas. The length of that season and the degree of accessibility vary greatly from year to year.

Rivers begin to break up early in June on the Arctic mainland. Their warming waters loosen the ice along the coast, and gradually widen cracks in the harbour ice. The loose floes are shifted about with the wind along the mainland coast during late June or early

July until finally a strong off-shore wind moves the ice out of the bays and inlets into the moving mass in the channels. This break-up comes later in July along the coasts of the Western Arctic islands.

Small lakes on the mainland break up around the end of June and larger lakes are ice-free by the middle of July. On northern Victoria and Banks Islands large lakes may still be frozen over early in August.

After the harbours are free of ice, there is a period of a few weeks before the floe ice is sufficiently broken for navigation along the coast. The open coast of Beaufort Sea, east of the Mackenzie delta, usually has a strip of open water along the shore by early August. At any time during the summer, however, strong northerly winds may push the heavy floes southward against the coast.

Coronation Gulf usually has enough open water for navigation by the end of July. The floes move about with the winds until they melt in the central part of the gulf. Strong north winds during this time, however, may block the south coast harbours. Shallow Queen Maud Gulf has ice until the latter part of August. Northerly winds bring additional floes southward through Victoria Strait from ice-packed M'Clintock Channel.

North of King William Island there is no ice-free season. Heavy polar ice from M'Clintock Channel pushes southward throughout the year. In some years the ice off the west coast of Boothia Peninsula is broken up enough to permit navigation through the floes for a few weeks at the first of September. North of Banks and Victoria Islands heavy polar ice brought in from the Arctic Ocean packs the channels and pushes against the steep coasts throughout the year.

Early in September the lakes in the northern parts of the region begin to freeze over. By the end of the month small lakes on the mainland generally have an ice-cover. Towards the end of September or early in October ice forms across the inlets and bays, and begins building out from the coast. By the end of November or early in December, Coronation and Queen Maud Gulfs are frozen over.

Ice conditions in the Western Arctic are difficult to predict because seasons vary, and ice movements are further controlled by local winds. Ice does increase the inaccessibility of the region, and is one reason for the contrast in development between this region and the nearby sub-Arctic Mackenzie Valley.

Transportation

Water transportation facilities are limited in the Western Arctic. The transportation system operates during the short and indefinite open season primarily to bring supplies to the few settlements scattered



rmer beach-lines hich have been rmed during glacial nes when the Arctic lands were at a wer level. These dges are a means of easuring the rate emergence since e melting of the ntinental ice-cap. ne buildings in the ckground are the rmer trading post n Wilmot Island, thurst Inlet.

A. L. Washburn



Loose, broken pack-ice surrounding the Tasmania Islands, off the west coast of Boothia Peninsula, in late August 1947.
J. L. Robinson

along the coasts. In the case of the Hudson's Bay Company and other traders, white fox pelts make up the only return cargo. The region has few resources and few people to need an elaborate transportation system.

Three schooners carry the bulk of the freight in the region. At present there are the 80-ton *St. Roch* of the Royal Canadian Mounted Police, the 150-ton *Fort Ross* and smaller *Nigalik* of the Hudson's Bay Company, and the 40-ton *Lady of Lourdes*, a Roman Catholic mission boat. Small schooners of about 25-ton capacity are owned by independent traders or Eskimos and make irregular trips throughout the region. In all cases schedules are elastic and are controlled by current ice conditions. Routes are more definite since the settlements are few, but the sequence of stops may sometimes be changed to take advantage of favourable ice conditions.

The transhipment point for Western Arctic freight is Port Brabant (Tuktoyaktuk). Supplies are brought down Mackenzie River by flat-bottomed river boats and barges, which first reach the Arctic around the middle of July. Freight is transferred to Arctic schooners which start out along the coast early in August. Formerly supplies were imported around the Alaskan coast. With the exception of periodic trips by the *St. Roch*, however, this practice has been discontinued, because of the uncertainty of ice conditions off the Alaskan coast.

The coastal vessels move eastward to their destinations in Amundsen and Coronation Gulfs. None of the larger ships now proceeds east of Cambridge Bay. Supplies for the isolated outposts at Perry River and Gjoa Haven are carried across island-studded Queen Maud Gulf by small Eskimo-owned schooners. One or two trips can be made in the summer, depending upon the ice season and the amount of supplies necessary. The vessels usually winter somewhere in the region, preferably returning to Tuktoyaktuk. The *St. Roch*, however, serves as a "floating police detachment" in the winter, being frozen in at a previously-selected harbour, from which the surrounding region may be patrolled by the officers of the vessel.

Air transportation is irregular in schedule in the Western Arctic. While regularly sched-



At Tuktoyaktuk (Port Brabant), transhipment point; Hudson's Bay Company's schooner Fort Ross *(on right) which supplies their trading posts, and stern-wheeler* Distributor *(on left) which pushes flat-bottomed boats down the Mackenzie River.*
J. Jaworski



R.C.A.F. Canso, and Department of Mines and Resources survey party setting up camp on the grassy tundra at Point Lake along the Coppermine River.
J. L. Robinson

uled mail flights serve Aklavik fairly frequently, service to other points is infrequent. During the summer, however, there are usually chartered aircraft or government planes flying the region. Most planes are float or ski-equipped and can land in the harbours or on the innumerable lakes. During winter it has been found that wheeled-planes can land safely on the thick and smooth harbour ice at most posts.

Local winter transportation is by dog-team and sledge. Dogs are hitched in tandem in the Western Arctic, unlike the fan-hitch characteristic of the Eastern Arctic where the sea-ice is generally rougher. Winter travel over the smooth sea-ice, or along low, snow-covered coasts is relatively easy in the Western Arctic. The mobility of the Eskimo for trapping or visiting usually depends upon the number and health of his dogs.

Natural Resources

Compared with the nearby Canadian Northwest the Western Arctic has few known resources and development faces many difficulties. With agriculture and forestry impossible, the region has only the minerals beneath the rocky surface and the animal life on land or in the sea.

Minerals

Copper was one of the reasons why the first white man, Samuel Hearne, entered the Western Arctic. Although it was used for generations by both Eskimo and Indian, it was not until 1911 that scientific investigations were made of the Coppermine River deposits. These reports indicated low grade deposits, although almost pure copper, which had been used for Eskimo weapons and utensils, could be found in small quantities. Low-grade copper deposits were also reported from Bathurst Inlet by geologists of the Canadian Arctic Expedition 1913-17. More intensive prospecting had to await the use of aircraft in order to take full advantage of the short open season when the exposed rock was snow-free.

The copper-bearing regions were examined carefully by two large mining companies in 1929 and 1930. Although numerous claims were staked, the deposits proved of too low a grade to withstand the high costs of transportation to the area. The claims have since lapsed as undeveloped. In 1943, with copper in demand and prices higher, the



Heavy polar pack-ice jamming M'Clintock Channel from shore to shore in late August 1947. These floes were several miles across, with very little open water. Patches of white snow lay on top of blue ice. The dark areas are water.
J. L. Robinson



Precambrian rock rising in north-facing escarpments, south of Minto Inlet on western Victoria Island. These ridges are separated by wide lowland valleys. The rocks are similar to those of the mineralized Coppermine series on the mainland.

A. L. Washburn

region around Dismal Lakes, west of Coppermine, was again investigated. In 1944 there were four prospecting parties in the area and over 100 claims were staked. Trenching and drilling of many of the lava flows revealed ores of chalcopyrite and bornite, but none has so far been found rich enough to warrant further development.

Reindeer

Until comparatively recent times the Western Arctic tundra area supported large herds of wild caribou. The failure of the caribou to migrate through this area in recent years resulted in distress to the local natives who had come to depend upon this animal as a source of food and clothing. In order to alleviate this precarious situation the Canadian Government decided to introduce reindeer into the region.

Reindeer stock was obtained from western Alaska. The drive across northern Alaska and the northern tip of Yukon Territory to the east side of the Mackenzie River delta commenced in 1929. It was completed after many difficulties and adventures by the delivery in March, 1935, of 2,370 reindeer to a corral near Kittigazuit.(3) The herds graze along the Arctic Coast in summer where cool breezes decrease the mosquito annoyance. Reindeer feed at that time includes a variety of vegetation—grasses, shrubs, sedges, etc. The principal roundups are held in midsummer with further roundups in the winter season when surplus stock is slaughtered for meat and hides. The winter grazing areas are usually 50 to 75 miles inland where there is an abundance of reindeer moss.

(3) The Canadian Government's Reindeer Experiment *Canada Year Book*, 1943-44.

The reindeer increased rapidly in numbers on the excellent grazing ground. Branch herds were started under Eskimo management near Anderson River in 1938 and 1940. However, a serious setback occurred in 1944 when the chief native herders with members of their families and a white supervisor lost their lives in the wreck of a native schooner. The reindeer were scattered and many animals lost. Those which could be recovered are being herded as a government unit at Anderson River. At the annual roundups held in the summer of 1948 there were more than 5,000 deer in the main herd located on the reindeer reserve and about 1,500 head in the Anderson River herd. A new attempt to establish a herd under

Using reindeer to haul sleds to the winter round-up site on the mainland near the Mackenzie River delta.

N.W.T. and Yukon Services





Headquarters for the Reindeer Station, located on the edge of the tree-line in the Mackenzie River delta. The reindeer herds summer in this area on nearby Richards Island.

N.W.T. and Yukon Services

Eskimo management was started in December 1948, by the separation of about 1,200 animals from the main herd. The new unit was driven to the Eskimo Lakes area.

The Canadian reindeer experiment has faced many difficulties in its short existence. The natives of the Arctic areas of northeastern Siberia and of Alaska herd reindeer and find that it gives them security in a region which lacks adequate food resources. One of the chief problems to be overcome is to change the Canadian Eskimos from nomadic hunters to herders. The herds are located near the Mackenzie delta which is one of the best trapping grounds in Canada. It is necessary to show that the security of reindeer herding is better than the attractions of the fur catch.

Fur Production

The only exported resource of the Western Arctic is the white fox pelt. This valuable fur-bearer is native to the Arctic and roams about on the tundra lowlands and sea coast in great numbers in some years. Unfortunately for the Eskimo, however, the white fox, like other fur-bearers, has a cycle of abundance. (4) The peaks of the cycle are followed by one or two years when foxes are scarce. A year of general recovery is often followed by another peak, about four years after the preceding one. These cycles were somewhat difficult to follow in the early years of the Western Arctic fur trade. The frequent opening and closing of trading posts caused a fluctuation in catches which may not have been typical of the numbers of the animal.

The number of white foxes trapped in the Western Arctic has increased rapidly within the past decade owing to the intensive trapping now practised by the Eskimos. Whereas trapping used to be a spare-time winter activity when traders first came into the area, it is now the major winter occupation. The total of 3,000 foxes trapped in 1934 was increased to 18,000 in 1939, and reached a record high of 30,000 white fox pelts in 1943. Even the catches of the low years of the cycle are now about equal to the peak years of 15 years ago.

Cambridge Bay supplies the major share of the Western Arctic white fox furs. This is partially due to the large catches which are brought to Cambridge Bay post for transhipment from King William Island and Perry River outposts. Coppermine also receives a large number of foxes during years of abundance. The mainland region produces an increasing number of red and cross foxes which are extending their ranges north of the tree-line into the tundra.

Population

The Western Arctic is thinly populated by both Eskimos and whites. There is a total of less than fifty white residents at the ten tiny post settlements in the region. Their occupations are those of fur traders, policemen, radio operators, weather observers, and missionaries. At one time there was a small group of white trappers operating along the coast and inland between Aklavik and Coppermine, but nearly all have now withdrawn. The mainland east of Coppermine is now included within the Arctic Islands Game Preserve, where hunting and trapping is restricted to Eskimos or half-breeds living the life of Eskimos. Thus,

(4) M. J. and J. L. Robinson, Fur Production in the Northwest Territories *Canadian Geographical Journal*, January, 1946.



The settlement of Cambridge Bay, Victoria Island. In foreground, unoccupied Anglican mission; centre, R.C.M.P. barracks; in distance, H. B. Company trading post and Eskimo tents.

J. L. Robinson

there are few occupations available for whites within the region.

The small Eskimo population of the Western Arctic totalled 1,582 according to the 1941 Dominion census. These few people are spread out over a region which measures 1,200 miles from Herschel Island to Boothia Peninsula. They inhabit the mainland north of the tree-line, and the southern part of Banks, Victoria, and King William Islands. The Western Arctic Eskimos may be subdivided into three chief groups, each of which differs in some respect from the others.*

The most westerly group is found between Herschel Island and the former post at Baillie Island. A few families of this group live farther east around the heads of Franklin and Darnley Bays. These people are primarily trappers, who have changed greatly from the primitive hunters of a few decades ago. Many of this group are Alaskan Eskimos who have migrated eastward along the coast following the opening of trading posts in the Mackenzie delta. Some Alaskans still come to the delta for the trapping season, and return to their hunting grounds on the Alaska coast in winter.

Most of the Eskimos of the Canadian coast west of Baillie Island migrate to the northern half of the Mackenzie delta in the spring to trap and shoot muskrats. Their harvest, combined with that of the Indians from the southern half of the delta, has totalled about 200,000 muskrats annually since 1935.

The specialized and wealthy trappers of Banks Island should also be included with these western Eskimos, since they return to Aklavik or "Tuktuk" each year. This small group of about forty Eskimos is well known because of its expensive schooners and modern equipment, but, unfortunately, it is often described as being typical of the whole Canadian Eskimo population. These Eskimos cross by schooner to Sachs Harbour, on the southwest side of Banks Island, and trap the area intensively during the winter. They live largely on white man's food while there, and spend little time hunting. Neither do they hunt seals for oil since they are well equipped with coal-oil stoves. In the summer, as soon as ice conditions permit, they return to

* The author acknowledges information received from Insp. H. A. Larsen, R.C.M.P., and E. J. "Scotty" Gall, H. B. Company.

Stanton, at the mouth of Anderson River, consists solely of a Roman Catholic mission.

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Aklavik with their catches, and relax there for a short time before freeze-up. Occasionally ice conditions have prevented their return to Banks Island, and they have spent a less profitable winter near Pearce Point.

The Eskimos of the delta coast live in driftwood or frame houses much of the year, unlike the remainder of the Canadian Eskimo population. These people are able to pick up driftwood which is brought down the Mackenzie River, whereas driftwood is seldom found in other Arctic regions. When they are travelling along trap-lines, however, they live in the typical Eskimo snow-block igloo, or in tents banked with snow-blocks.

One of the chief native foods of the western group of Eskimos in summer and autumn is white whale* which is found along the coast as far east as Baillie Island. Usually organized hunts are held in July or August, and great numbers of these porpoises are shot as they travel in schools. The carcasses are then dragged to shore where they are cut up by the women. The meat is cached, sometimes in underground ice-houses dug into the permanently frozen sub-soil, but often it is dried on racks for winter use. The oil and blubber are stored in drums, later to be rendered down for use in lamps during the winter.

These people hunt off the floe edge part of the winter, but are not as efficient seal hunters as are other Eskimo groups. Many of them are inclined to live more on food obtained from the stores, or from the excess of the reindeer herds. Caribou are occasionally obtained inland from Stanton and the head of Franklin Bay, and are also hunted along the strip of Yukon coast near Herschel Island. The lack of caribou in this region has been alleviated by the introduction of reindeer to Richards Island.

The largest group of Western Arctic Eskimos is the central people who inhabit southern Victoria Island and the mainland region east of Coppermine to Perry River. They are separated from the more prosperous delta Eskimos by an almost uninhabited section of coast between Darnley Bay and Stapylton Bay. Some of these



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Shy Eskimo woman and girls at Minto Inlet, western Victoria Island. They wear the typical Mother Hubbard dresses in summer.

Eskimos are great travellers, but their movements are quite irregular, varying from season to season. A family that may hunt at the headwaters of Burnside River one summer may be 300 miles away on the west coast of Victoria Island next summer.

It is difficult to generalize on the activities of the central group because they vary from year to year and from place to place. The Copper Eskimos who hunt inland southeast of Coppermine settlement prefer caribou to any other food, but also obtain fish from the lakes in early winter and spring. In the summer they travel about on the tundra seeking caribou and living in caribou-skin tents. The usual migration routes of the caribou are known, and as the animals begin to move southward in August, Eskimos collect at certain vantage points in the hope of killing large numbers. The meat is then either cached in the frozen ground and the place marked by caribou antlers, or it is dried in the sun for future use. The excess hides are usually traded at the post at Burnside Harbour.

As long as they have sufficient meat, or can hunt small caribou herds the Copper Eskimos may stay on the barren grounds throughout the winter, combining hunting and trapping. On the other hand if caribou

**Delphinapterus leucas* Pallas



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Old Eskimo from western Victoria Island, with primitive native goggles, worn to prevent snow-blindness, pushed above his eyes.

are lacking, the families will migrate to the coast in winter or spring and begin sealing. A similar group of Eskimos lives inland from Bathurst Inlet. They follow caribou most of the year, but come to the coast occasionally, chiefly for sealing in April. They are not as good nor as interested trappers as the Copper Eskimos. Many of these people who come out to the coast are primarily trappers and only hunt seal if they are hungry. Seals are shot or harpooned through breathing holes in the ice of Coronation and Queen Maud Gulfs. Large sealing camps may be established at favourite hunting sites, as for example, north of Coppermine, and near Kent Peninsula.

The few Eskimos who live around Prince Albert and Minto Inlets, on the west side of Victoria Island, depend on seals for food since caribou have become scarce on the island. They make inland trips into the hilly region during early winter to fishing lakes and also to look for caribou. They occasionally cross to southeastern Banks Island. These Eskimos have not become as specialized trappers as those farther south. No one lives on northern and eastern Banks Island nor along the northern and eastern coasts of Victoria Island.

The Eskimos living on southeastern Victoria Island, around Cambridge Bay, are one of the more prosperous and progressive sections of the central group. They inhabit the coast from Wellington Bay around to Albert Edward Bay. Their seasonal round of activities is illustrative of the adaptation of the modern Eskimo to his environment.

In late August the Eskimos establish their autumn fishing camps at the mouths of rivers when the Arctic char begin running upstream. The fish are netted in large quantities for about three weeks and stored for winter dog feed. Early in September autumn sealing starts along the coasts and lasts until freeze-up. Since there are no kayaks in the Western Arctic the Eskimos use manufactured boats with gasoline engines. If this sealing period is good, the Eskimo supplies himself with much of his winter's food. During the remainder of October, after freeze-up, Eskimos return to the fishing streams or inland lakes. There they stretch their nets under the ice and catch more dog feed and food for winter's use. Storage is no problem since fish can be kept frozen.

The trapping season opens on November 1st, and for the remainder of the winter the Cambridge Bay Eskimo is an energetic trapper. The intensity of his trapping, however, depends upon the amount of seal meat which he is able to store or catch during the winter. If autumn sealing in the open water has been poor, he will seal again in November at breathing-holes through the ice. This is slow, patient work for a seal has several breathing holes and may not visit the one where the hunter awaits. A small group of families usually assemble at the early winter sealing camp, and any catch is shared equally. The snow houses are heated with small kerosene Primus stoves or the ancient stone seal-oil lamps.

While sealing is going on, some of the men will have laid out their trap-lines. Each man has his own region. His trap-line will extend probably forty to seventy miles and average about 200 traps. Most lines start at the coast and run inland over the low, snow-covered tundra. Sometimes whole families move along the trap-lines, visiting other families when their lines cross. If foxes are

abundant, pelts will be taken to Cambridge Bay and exchanged for white man's food, which permits the Eskimo to spend more time on the trap-line and less time sealing. The foods most commonly used are flour, rolled oats, rice, dried potatoes, and large quantities of tea.

In April the trapping season is over and families again assemble at favourite sealing sites along the south and southeast coast of Victoria Island. Since the seas are completely frozen over there is no floe-edge sealing, as in the Eastern Arctic, but only patient, cold waiting at breathing holes with gun and harpoon. This is the friendly visiting season of the Eskimos, called "*Paloktok*". Days are lengthening, temperatures are moderating, and if sealing is good, families move from one camp to another. Visitors are welcomed with feasts and dancing, and stories are sung of their respective winter's exploits.

Spring sealing lasts until early July, when the ice begins to break up. Eskimos then move their tents to the mouths of well-known fishing streams, where the spring run from the lakes is netted. As soon as the ice is clear of the coast, the boats which were beached in autumn are floated again. Eskimos gradually assemble around the Cambridge Bay post in August, bringing in the remainder of the winter's white foxes, and awaiting the arrival of the annual supply schooner. Once their new equipment and supplies are received, the happy people again disperse to their respective camps and another year's activities begin.

The Eskimos trading at Perry River are of two chief types. Those living along the coast are similar to the Cambridge Bay Eskimos. The major difference in activity is their autumn caribou hunt in late August on the mainland. These people inhabit the coast from Ellice River to Ogden Bay. There are very few Eskimos along the mainland coast between Bathurst Inlet and the eastern end of Kent Peninsula.

The second group of Eskimos who come to Perry River are the little-known inland people who live along Back River and around Garry Lake. This primitive group stays inland most of the year, existing on caribou and fish, and is little concerned about trapping. They sometimes trade eastward at Baker Lake, or occasionally come to Perry River post, which is operated by an Eskimo, to trade for a few essential goods.

A larger primitive group of Eskimos, the Netsilik, are those inhabiting the region from Adelaide Peninsula to Pelly Bay and northward in Boothia Peninsula. They occasionally cross over the ice to southern and eastern King William Island. The Netsilik Eskimos may be sub-divided into several small groups of families who have little contact with one another and often trade in opposite directions. The people trading at Gjoa Haven, King William Island, live on the flat shores of Adelaide Peninsula and northeastward from Chantrey Inlet. The group on Boothia Penin-

Eskimo boy from King William Island. He had been to school at Aklavik, spoke good English, and was a fine mechanic.

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sula stay chiefly on the east side around Thom Bay, and traded at Fort Ross when that post was open. The Pelly Bay natives centre their activities around the mission there.

The Netsiliks are primarily coastal dwellers. They live on fish most of the summer, obtained with their primitive fish spears and stone dams. Their winter sealing camps are small, usually consisting of five or six hunters. Their inland trips for caribou, in August or early September, are occasional and irregular. As a result, lack of suitable winter clothing is often one of their serious problems. As an isolated group, difficult to reach from either the west or east, the Netsiliks have been less affected by white man's customs and utensils.

Summary

The Western Arctic is a little-known part of Canada, and has played a relatively unimportant role in the national economy of this country. Natural conditions, such as lack of soil and forests, cold climate and unfavourable ice conditions have placed many obstacles in the way of development. White fox pelts are the only resource exported from the area. The region has caribou on land and seals in the sea which support a scattered Eskimo population. White residents are few, and live in small post settlements.

Access to this vast region is by air from Yellowknife to Coppermine, or via the Mackenzie River system to Aklavik and the Mackenzie delta or from the seaward approach by way of Bering Strait and Beaufort Sea. Its geographic location, remote from the principal centres of Canadian commerce and industry, has hindered the development of the Western Arctic in the past. Recent exploratory investigations by air, however, including the 1947 expedition to determine the exact location of the North Magnetic Pole, and mineral investigations in the Coppermine and other Western Arctic areas, have greatly increased our knowledge of the region. They indicate possible resources which may have a marked effect upon the strategic importance of the Western Arctic in relation to sub-Arctic Mackenzie District and the Eastern Arctic. These considerations may well outweigh an unfavourable natural environment, and enable the Western Arctic to assume an entirely new significance in the future development of Canada's northern territories.



Eskimo woman and her daughter, western Victoria Island.

J. Jaworski

Cover photograph:

Royal Canadian Mounted Police barracks at Cambridge Bay, Victoria Island.

J. L. Robinson

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PHYSICAL GEOGRAPHY OF THE CANADIAN EASTERN ARCTIC

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PHYSICAL GEOGRAPHY OF THE CANADIAN EASTERN ARCTIC

(This article was prepared specially for the 1945 edition of the Canada Year Book under the direction of R. A. Gibson, Director, Lands, Parks and Forests Branch, Department of Mines and Resources, Ottawa.)

The Eastern Arctic may be defined generally as that part of northeastern Canada, lying north of the tree-line, which is serviced from the Atlantic Ocean and Hudson Bay. It embraces much of the Northwest Territories, including most of the large and numerous Arctic Islands, as well as part of northern Quebec, and contains a land area of about 700,000 square miles or 19 p.c. of the total area of Canada. The District of Keewatin includes the mainland of Canada west of Hudson Bay and north of the 60th parallel as far west as 102° west longitude. The islands in Hudson and James Bays also lie within Keewatin District. The District of Franklin comprises the remainder of the Arctic Islands as far north as the North Pole, together with Boothia and Melville Peninsulas of the Canadian mainland. The Arctic mainland of northern Quebec, formerly the District of Ungava, also lies within the Eastern Arctic and, although its resources are under provincial administration, the Eskimo population at present is the responsibility of the Northwest Territories Administration. Within the Eastern Arctic, which is about twice the size of the Province of British Columbia or about equal to the areas of Quebec and Manitoba combined, live about 150 Whites and 6,000 Eskimo, the latter representing four-fifths of the entire Eskimo population of Canada.

Geology.—The foundations of the Eastern Arctic consist of two chief kinds of rock. Most of the area is underlain by Precambrian rocks of the Canadian Shield, which comprises the geologic base of two-thirds of Canada. Sedimentary rocks, ranging in age from Palæozoic to small local areas of Tertiary, form a belt through the central Arctic Islands and include most of the far northern and western Arctic Islands. In general, the areas of Precambrian rocks are more rugged and rounded, while sedimentary rocks more typically result in level or low-relief topography.

The ancient assemblages of sediments and volcanics which occur amid the predominant granites and gneisses of the Canadian Shield in the Eastern Arctic are similar to those that have yielded rich and abundant minerals in the better-explored areas of the southern and western sections of the Shield. Since the later sedimentary rocks were laid down after the last known period of widespread mineralization in Canada, they may be excluded as promising sources of metalliferous deposits. Such rocks, however, may still be considered as possible sources of coal, oil or gas.

Much or all of the Eastern Arctic was glaciated during the last Ice Age which covered most of Canada with ice several thousands of feet thick. This ice-sheet had some of its centres and perhaps its main source of origin in the Eastern Arctic. Areas of permanent ice-caps, glaciers, or snowfields still cover several large sections of Ellesmere Island, much of Devon and Bylot Islands, and scattered areas along northeast Baffin Island. Such areas are thus excluded from any hopes for present economic development.

When the ice load decreased at the end of the Ice Age the land slowly began to rise. Ancient beach ridges and terraces, now found over 500 feet above the present water-level, have recorded this rise for geologists. Except in the mountainous areas, most of the present surface which was exposed after the ice melted back is subdued glacial topography. Bare, rounded hills of rock are separated by broad, drift-filled valleys. Post glacial frost action has caused disintegration of the exposed rock covering the surface with loose frost-riven debris.

Topography.—The region west of Hudson Bay is one of countless lakes and streams. Although there are no extensive areas of high relief, local rugged sections are to be found. In general the region consists of an interior plateau area where altitudes average about 1,000 feet, and an emerging coastal plain, covered by glacial drift, which slopes towards Hudson Bay and the Arctic Coast. The rolling plateau surface is marked by linear rock ridges which give it a furrowed appearance. Long, narrow lakes often occupy the intervening valleys.

The plain along the west coast is about 50 miles wide at Churchill and broadens northward to extend as far inland as Yathkyed and Baker Lakes. North of Chesterfield Inlet the country is more rugged, but gradually slopes down towards the broad, sandy valley of Back River to the west, and on the east, to a low, monotonous coast along Roes Welcome Sound. Melville Peninsula is a plateau area with a steep-sided west coast and a shelving, terraced area along the central and northern sections of the east coast. In winter, travel is fairly easy by dog team across the frozen, snow-covered surface of the low areas west of Hudson Bay, but in summer the myriads of lakes, swamps, and intervening spongy muskeg confine travel chiefly to the main rivers.

The permanently frozen ground of the Eastern Arctic prevents underground drainage, so that lakes collect in low areas and spill uncertainly from one to another. This and the disruptive effects of glaciation on drainage have combined to cause a poorly integrated drainage system. The three major rivers, Kazan, Dubawnt, and Thelon, which cut across the inner plateau, flowing northeastward at right angles to a general alignment of the bare, rocky ridges, finally empty into Baker Lake. All three rivers broaden out into lakes at several places along their courses. These rivers have been the routes of early explorations, and are fairly well mapped, but actually from the air they may be very difficult to pick out from the numerous un-mapped lakes and rivers that surround them.

Southampton Island has two distinct physiographic regions. The larger part, southwest of a line drawn roughly from Duke of York Bay in the north to South Bay and Seahorse Point, is low, flat limestone country. Sloping terraces that mark ancient beach lines are the chief topographic features. Along the northeastern part of the Island rugged Precambrian hills rise abruptly above the limestone plain to altitudes of 1,000 to 1,500 feet.

Coats and Mansel Islands are composed chiefly of limestone and have flat or gently rolling surfaces. Local high areas do not exceed 500 feet in altitude. Nottingham and Salisbury Islands, at the western end of Hudson Strait, are part of the Precambrian complex. Their bare, rocky, indented coasts rise abruptly from the water and, when seen from a distance, present a level, peneplain surface with an altitude of a few hundred feet. Although the rock surface of these two islands is rounded, the local surface has a rugged character imparted by many valleys and rock ridges.

Ungava Peninsula of northern Quebec is a rolling plateau area of low, rocky hills of Precambrian age, dotted with innumerable lakes and drained by many streams. In general, the plateau rises fairly abruptly to altitudes of 1,000 to 2,000 feet along the Hudson Bay and Hudson Strait coast, on the west and north, and slopes gradually down towards Ungava Bay on the northeast, forming a horseshoe-shaped upland around this Bay. The interior surface is composed mainly of rolling, bare, rocky hills separated by broad valleys containing lakes and glacial fills of boulders and gravel. Except for routes along a few major streams, the drainage of Ungava has not been mapped, so that very little is known about the accessibility of the interior by water.

Baffin Island is the largest of the Canadian Arctic Islands. Its area of 200,000 square miles is about equal to the size of the Province of Manitoba. In such a vast area a variety of topographic features are found, and some of them present the most spectacular scenery of Eastern Canada. Along the eastern coast of the Island, from Cumberland Sound on the south, to Lancaster Sound on the north, and including Bylot Island, a high, rugged mountain range of Precambrian age rises to altitudes of about 10,000 feet in places, and averages 5,000 to 7,000 feet. These mountains are therefore, together with those of northern Ellesmere Island, the highest ranges in Eastern North America. Jagged peaks and serrated ridges are partially buried under permanent snowfields and ice-caps in some areas. Long, twisting glaciers fill many valleys and discharge into the sea at several places. The whole coast, with its indentations and fiords, rises abruptly from the water, presenting a formidable barrier of rugged grandeur toward Davis Strait and Baffin Bay.

Southern Baffin Island has a drab, rounded coast of bare rock which rises to an altitude of about 1,000 feet. A belt of numerous small islands fronts the central part of the south coast. Most of the interior is a rolling plateau area, averaging 2,000 to 3,000 feet in elevation. This barren upland area slopes down to the north and west to a broad tundra plain which covers the area west of Amadjuak and Nettilling Lakes and extends along the Foxe Basin coast as far northward as the Hantzsch River. The lake-dotted and swampy plain there is somewhat similar in appearance to the tundra area along the west coast of Hudson Bay.

Northwestern Baffin Island is a plateau area underlain by sedimentary rocks of Palæozoic Age and surfaced by disintegrated slabs. The plateau itself is rolling, but the coasts along Admiralty and Prince Regent Inlets are vertical walls of stratified rock, rising to altitudes of 500 to 1,000 feet.

Devon and Ellesmere Islands are the largest of the most northerly group of Arctic Islands. Ellesmere Island alone is almost as large as England and Scotland. Both islands have steep rocky eastern coasts. Parts of their interiors are covered by extensive ice-caps. The sedimentary rock of the western coasts gives low rolling areas which supply sufficient vegetation for roaming herds of caribou and musk-ox.

The Parry and Sverdrup groups of islands have a base of sedimentary rock, which has resulted in a generally low or rolling topography. Coasts are generally shelving terraces or low rounded hills. Large-scale topographic features are lacking in the interior, although occasional transverse valleys have been known to hinder winter travel.

Hydrography.—Including the islands of the Western Arctic, there are 17 major Canadian Arctic Islands over 1,000 square miles in area, about 40 islands larger than 100 square miles, and large numbers of smaller ones. The straits, sounds,

and channels which separate the Arctic Islands vary in width from a few miles to over 100 miles, with the chief separating bodies of water averaging about 50 miles wide.

Arctic waters move eastward and southward from the basin of the Arctic Ocean through these islands and enter Baffin Bay via Smith and Lancaster Sounds. Another current passes through Fury and Hecla Strait into Foxe Basin, west of Baffin Island. The waters from Baffin Bay flow southward past the east coast of Baffin Island through wide Davis Strait, along the coast of Labrador and into the North Atlantic. A northward-moving current from the Gulf Stream (North Atlantic Drift) merges with the current from East Greenland and flows northward along the west coast of Greenland through Davis Strait, finally joining the southward-moving Arctic Current in northern Baffin Bay. A great contrast in climate is found on the opposite shores of Davis Strait, due to the temperature differences between the cold Arctic Current off Baffin Island and the relatively warmer current touching the west coast of Greenland. This fundamental fact of ocean currents explains a great deal of the past history of settlement and present possibilities of these two areas.

So far as is known, tides are not high in the far northern Arctic waters. Records have been taken only for short periods at a few stations. On the east coast of Baffin Island, in the fiords of Cumberland Sound and Frobisher Bay, the tides reach surprising heights of 20 to 30 feet, owing to the tidal waters being compressed into the narrow inlets.

At Hudson Strait the Arctic Current branches westward around Resolution Island and flows along the south coast of Baffin Island. Near the western end of the Strait this Current meets waters moving southeastward from Foxe Channel, and the combined current then drifts eastward along the north coast of Ungava Peninsula, finally joining the main southerly Labrador Current.

There is a counter-clockwise current in Hudson Bay. Waters move southward around Southampton Island through Roes Welcome Sound and Fisher Strait and along the west coast of the Bay. The current follows the general oval shape of Hudson Bay, flowing northward past the east coast and joining the eastward-moving stream in Hudson Strait.

The tides in Hudson Strait have an unusual range, owing to the Atlantic waters being funnelled into the narrower space of the Strait. Tides average 25 feet neaps and 30 feet springs at Ashe Inlet on the northern side of the Strait, and range from 20 to 35 feet neaps and springs at various places along the southern coast. The tidal range becomes less towards the western end of the Strait and in the more open areas adjacent to Hudson Bay. Such tidal ranges offer no serious problems to ocean-going ships with experienced navigators in Hudson Strait, but present a real hazard to small coastal schooners or inexperienced pilots. A knowledge of the intricacies of the tides helps to explain some of the problems of servicing the tiny settlements of this region, where no permanent wharves are available, and where ships can often discharge cargo only at high tide, and then only by means of lighters.

In Hudson Bay the tides do not have so great a range as in Hudson Strait. Most of the harbours are open to the sea and thus have no constrictions to increase tidal rises. At Churchill tides average from 12 to 15 feet. The tidal undulation progresses in a counter-clockwise movement around Hudson Bay. At Port Harrison, on the east side of the Bay, the influence is almost spent so that tides are recorded as being only 3 to 4 feet.



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Climate and Weather.—In climatic terms, an Arctic area is one where the average mean temperature for the warmest month is not above 50° F. In Northern Canada the isotherm delimiting this area is generally slightly north of the tree-line. Thus the Eastern Arctic is a treeless area, except for small, stunted willows which grow in sheltered valleys. The general climatic conditions are those of long, cold winters and short, cool summers.

Owing to the large amount of water within the Eastern Arctic region, minimum winter temperatures are not so low as in some other areas of the interior of Canada or northern United States. The modifying marine influence delays the coldest period so that February is generally the coldest month at each station. Average winter monthly mean temperatures range from −20° to −30° F. at the most northern Eastern Arctic posts, and vary from −10° to −20° F. in the Hudson Bay and Strait area. Absolute extremes of about −50° F. have been recorded at most of the posts, with the record low of −60° F. having been reported at both Pond Inlet and Chesterfield. At most of the stations there is an average of 4½ months in which monthly mean temperatures are below 0° F.

For the four months of June to September the average monthly mean temperature is above 32° F. in most of the Eastern Arctic. During the short summer season vegetation comes to life in the valleys which contain soil; flowers blossom forth in colorful beauty; and myriads of mosquitos swarm over the low, wet areas. Average daily summer maximum temperatures are in the cool 50's, but extreme maximums of over 70° F. have been known at most of the stations. A record high of 84° F. has been recorded at Chesterfield, on the edge of the Barren Lands, while 81° F. has been reached at Lake Harbour and Cape Hopes Advance on Hudson Strait. The Eastern Arctic stations have not recorded the same high summer temperatures that are known in the Mackenzie Valley in the western part of the Northwest Territories.

When the factors of a short summer season are combined with a general lack of developed soil, it becomes apparent that agriculture under natural conditions is not possible. The shortness of the growing season is illustrated at Chesterfield, where the longest average frost-free period of the Eastern Arctic stations is only 67 days. In addition, variability is a great hazard prohibiting an attempt to grow anything, for at Chesterfield first autumn frosts have occurred as early as August 1 and as late as October 3. Autumn frosts usually occur much earlier on the east side of Hudson Bay, where the marine influence of the cold waters of the Bay is more dominant—Port Harrison has an average of only 44 frost-free days. Similar conditions are found on Baffin Island where the average last frost occurs in late June and the average first frost comes in mid-August. At the far northern post of Pond Inlet there is an average frost-free period of only 29 days, with freezing temperatures having been recorded in every month.

Precipitation is not heavy in the Eastern Arctic, but because of slow evaporation snowfall remains on the ground throughout the winter. Southeastern Baffin Island receives the greatest amount of precipitation because moist winds blow in from the North Atlantic. In this area approximately 8 inches of rain is evenly distributed throughout the four summer months. Seventy to ninety inches of snow is the usual winter recording, with a maximum falling in the late autumn. The east coast of Hudson Bay has a greater amount of precipitation than the west coast owing to higher elevations and prevailing on-shore winds. At the far northern Arctic Islands posts an average of 2 to 4 inches of rain plus 30 to 60 inches of snow have been recorded.

Prevailing wind directions are difficult to determine for the whole region because most of the meteorological stations are located in sheltered areas and wind directions are controlled by some topographic influence. Winter winds appear to be predominantly from the north or northeast at the far north stations, and blow generally from the west or northwest in the Hudson Bay and Strait area. Arctic conditions and temperatures are thus extended towards the south by these generally northerly winds. During the summer months the southern half of the region is under the influence of weak cyclones which move eastward across the country and bring a variety of wind directions and no prevailing wind. Wind velocities are generally low during the summer and become stronger in the winter. Gales of several days' duration may occur at any time during the winter months, but are most common from October to December. Paradoxically, calms also occur most frequently in the winter as cold polar air masses settle over the region.

The prevalence of summer fog is one of the hazards of the coastal regions of the Eastern Arctic. When relatively warm air masses from the land come in contact with the cold waters of Hudson Bay and the Arctic Islands, condensation occurs, causing fog and low clouds to be frequent. The meteorological stations in Hudson Strait have an average of 7 to 12 days in each of the four summer months in which fog is recorded, and as many as 15 to 25 days of fog in any one month. Fogs are less frequent during the winter when temperatures over land and sea are more nearly equal. The many foggy days of the summer present a problem to both water and air transportation in this region.

The climate of the Eastern Arctic thus is combined with the disadvantages of topography and lack of soil to make the region a difficult one for future hopes of exploitation. The climate itself is not so severe as in some other Arctic areas, but the southeasterly direction of movement of weather and ocean currents has extended this Arctic climate farther south into the mainland of Canada. The interplay of these natural factors has thus brought the Arctic as far south as latitude 60 on the west side of Hudson Bay, and to about latitude 57 on the eastern coast of the Bay. This is about ten degrees, or 700 miles, south of the Arctic Circle, and about the same latitude as the good farming region of the Peace River of Western Canada. Thus, much of northeastern Canada, comprising about one-fifth of the Canadian land area, has limited chances for development because of unfavourable factors of climate and lack of soil.

Ice Conditions.—*Sea Ice.*—The direction of movement of drifting ice is the result of the interplay of the forces of ocean currents and winds. Ice-floes drift along with the major ocean currents, but deviations from the normal may be caused at any time by changes in prevailing winds. Estimates of the usual times of appearances and direction of movement of the ice masses and bergs are thus possible through consideration of the known facts of hydrography and climate.

In the far northern Arctic Islands ice begins to set along the shores about the end of September. As the weather becomes colder this sea ice grows outward and if the islands are close together, they are linked by ice bridges which make travel easy from one island to another. The larger straits may not become completely frozen over, but they will be choked with drift ice from the sea of moving ice in the Arctic Ocean. The ice-floes may freeze together to form temporary bridges which may break up again in the next storm.

In Baffin Bay and Davis Strait drifting ice from the channels between the Arctic Islands is supplemented by numerous bergs breaking off principally from the

glaciers of Greenland and to a much lesser extent from those of the northern Eastern Arctic. These ice-fields begin to spread southward, first in narrow strings of ice and later in broad floes and masses. By November the pack-ice has blocked the entrance to Hudson Strait and is joined by more ice from the Strait, spreading southward along the Labrador Coast. By late December it appears off the coast of Newfoundland. The Baffin Bay pack-ice is reported to reach its greatest extent in March and April, with ice moving northward along the southwest coast of Greenland, a 'middle pack' moving southward into Davis Strait and the 'west' ice following the Labrador Current southward along the coast of Baffin Island.

In Hudson Bay and Strait the sea ice builds out from the shore for a distance of 5 to 7 miles on the average, generally starting to freeze towards the end of October. The harbour ice attains a usual thickness of about 5 feet during the winter, but outside the sheltered places storms may slide the masses over one another until such 'rafted' ice may have a thickness of several tens of feet. Recent aerial information shows that the central part of Hudson Bay freezes over during the winter, with possibly an open area between this mass and the shore ice. Although Hudson Strait does not freeze over from shore to shore, the centre of the channel is blocked throughout the winter by loose ice which moves east and west with the tidal currents.

In late June the sea ice begins to break up and joins the general drift of the currents towards Hudson Strait and the North Atlantic. During much of July, Hudson Strait remains unnavigable as this ice moves outward. Prevailing winds will influence the time of accessibility of most of the harbours. A westerly wind will tend to clear the ice out of the Strait earlier in the season, and a period of easterly winds will hold it back and block the western end of the Strait. Northerly winds will push the ice into the harbours on the southern shore of the Strait and delay their opening, and prevailing southerly winds will tend to block the north coast harbours. The route into Hudson Bay is generally free of ice during August, September, and most of October, so that ocean-going vessels may navigate with freedom. Toward the end of October or early November the sea ice again begins to form and the Eastern Arctic is cut off from outside communication by boat for another nine months.

River and Lake Ice.—The dates of break-up and freeze-up in the lakes and rivers of the Eastern Arctic are important in understanding further problems of accessibility, especially for ski- or pontoon-equipped aeroplanes. The river ice in the District of Keewatin usually breaks up in middle or late June, with southerly rivers generally being free of ice earlier than more northern ones. Floating ice will be found for several weeks after the beginning of break-up.

Size and depth of lakes are factors affecting the time of break-up with the smaller lakes clearing first. Most of the lakes are free of ice during the first half of July. However, the large ones may have considerable floating ice long after break-up if their outlets are not large enough to carry away the floes. Drifting ice has been known to remain in some of the lakes into early August before melting. Early in September the lakes and rivers begin to freeze over in the northern sections and by early October they are usually all frozen throughout the Eastern Arctic.

Summary.—This brief summary of geographic conditions in the Eastern Arctic illustrates the fact that the vast region has a harsh natural environment. Many areas consist of ice-caps, glaciers and permanent snowfields; other sections are constituted solely of barren bed-rock or glacial deposition. The whole land area

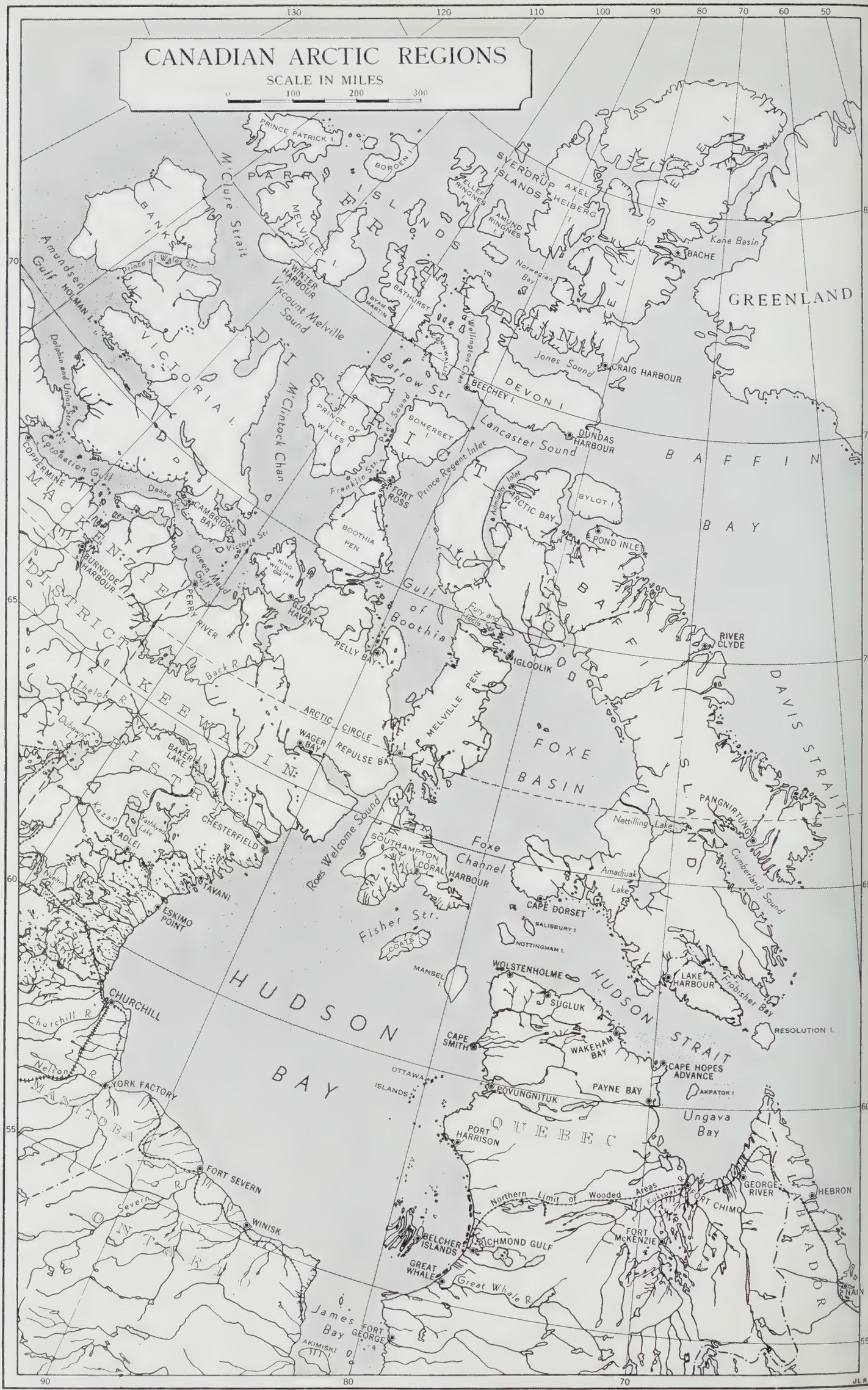
is covered with snow for nine months of the year, and at the same time the surrounding seas are icebound. Temperatures rise during the short summer period and vegetation flourishes, but lack of developed soil combines with cool summer temperatures to prevent agriculture.

Although the limited possibilities of the Canadian Eastern Arctic have given little encouragement to white settlement, they have been able to support four-fifths of the Canadian Eskimo population. Wildlife resources of the land and sea, supplemented by white man's trade goods exchanged for white fox furs which are trapped during the winter, have adequately maintained this migratory and widely spread people. Their implements and customs have developed from centuries of battling the unfriendly geographic facts of their environment.

A Brief History Of Exploration And Research In The Canadian Eastern Arctic



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CANADIAN ARCTIC REGIONS
SCALE IN MILES
0 100 200 300
PRINCE PATRICK I.
BORDEN I.
MELVILLE I.
BANKS I.
PARRY ISLANDS
SVERDRUP ISLANDS
AXEL HEIBERG I.
ELLEF RINGNES I.
AMUND RINGNES I.
EUREKA
ELLESMERE I.
Kane Basin
BACHE
GREENLAND
Norwegian Bay
Wellington Chan.
Jones Sound
CRAIG HARBOUR
DEVON I.
BEECHEY I.
DUNDAS HARBOUR
Lancaster Sound
BAFFIN BAY
Barrow Str.
M'Clure Strait
Amundsen Gulf
HOLMAN I.
Prince of Wales Str.
WINTER HARBOUR
Viscount Melville Sound
BYAM MARTIN I.
BATHURST I.
CORNWALLIS I.
VICTORIA I.
DISTRICT OF MACKENZIE
Dolphin and Union Str.
Coronation Gulf
COPPERMINE
Dease Str.
CAMBRIDGE BAY
PRINCE OF WALES I.
SOMERSET I.
Peel Sound
Franklin Str.
FORT ROSS
Prince Regent Inlet
Admiralty Inlet
ARCTIC BAY
BYLOT I.
POND INLET
BOOTHIA PEN.
KING WILLIAM I.
Victoria Str.
Queen Maud Gulf
BURNSIDE HARBOUR
PERRY RIVER
GJOA HAVEN
Gulf of Boothia
Fury and Hecla Str.
IGLOOLIK
RIVER CLYDE
PELLY BAY
MELVILLE PEN.
DISTRICT OF KEEWATIN
Back R.
Thelon R.
ARCTIC CIRCLE
WAGER BAY
REPULSE BAY
FOXE BASIN
FOXE PENINSULA
DAVIS STRAIT
Dubawnt L.
BAKER LAKE
Kazan R.
Kathleen Lake
PADLEI
CHESTERFIELD
Nueltin L.
TAVANI
ESKIMO POINT
Roes Welcome Sound
SOUTHAMPTON I.
CORAL HARBOUR
Foxe Channel
Nettilling Lake
PANGNIRTUNG
Amadjuak Lake
CAPE DORSET
SALISBURY I.
NOTTINGHAM I.
Cumberland Sound
Fisher Str.
COATS I.
MANSEL I.
WOLSTENHOLME
SUGLUK
LAKE HARBOUR
Frobisher Bay
RESOLUTION I.
HUDSON BAY
HUDSON STRAIT
CHURCHILL
Churchill R.
CAPE SMITH
WAKEHAM BAY
CAPE HOPES ADVANCE
AKPATOK I.
Nelson R.
YORK FACTORY
OTTAWA ISLANDS
POVUNGNITUK
PAYNE BAY
Ungava Bay
MANITOBA
PORT HARRISON
QUEBEC
FORT SEVERN
Severn R.
WINISK
Northern Limit of Wooded Areas
Koksoak R.
GEORGE RIVER
HEBRON
PORT CHIMO
BELCHER ISLANDS
RICHMOND GULF
FORT McKENZIE
LABRADOR
GREAT WHALE
Great Whale R.
NAIN
James Bay
FORT GEORGE
AKIMISKI I.
ONTARIO
130 120 110 100 90 80 70 60 50
90 80 70
80 75 70 65 60 55
JLR

A Brief History Of Exploration And Research In The Canadian Eastern Arctic

by P. D. BAIRD and J. L. ROBINSON

THE far northeastern territory of Canada has been one of the most inaccessible regions of the world. The story of the gradual unfolding of its secrets is a fascinating one, over three centuries long, in which the principal characters—mariners, scientists and others—have all been fired by the same indefinable urge for discovery. Lured on by the search for the unknown and the thrill of first discovery, and despite hardships and death, expeditions and individuals have gradually extended our knowledge of the Canadian Eastern Arctic.

The methods aims and size of the expeditions have undergone gradual changes. The earliest discoveries belong to the age of sail, and, in craft of ten to a hundred tons, the adventurers of this period dared the Atlantic and the northern pack-ice for brief summer seasons. Later, the dread of wintering within the Arctic was overcome, ships became larger, and steam-power provided assistance in the ice. Gradually the explorers learned to use the methods of the Eskimo in sledge travel, hunting, and winter dwellings. Parties became smaller and more precise in aim as the frontiers of knowledge were expanded.

Much remains to be done in the Eastern Arctic. Our knowledge of many phenomena is still incomplete and needs correlating with facts known about other Arctic areas and regions south of them. Air transport and modern technological aids have brought the Arctic closer to the outside world, making travel and wintering easier, but each expedition must lean on the experience of the past and acknowledge the work of the early explorers who achieved so much under such great material handicaps.

First Period—To 1818

Although it is fairly certain that Leif Erikson, travelling from Greenland to America in 1000 A.D., touched the southeast shores of Baffin Island, and thus has the honour of being the first discoverer, a gap of centuries follows before further explorers enter the region. The Columbian concept of a western route to the wealth of the Far East was the lure which sent explorers to the coasts of America. England, Spain, Portugal, and France outfitted expeditions which reached the newly discovered continent in the neighbourhood of Newfoundland and farther south, and it was not until 1576 that the first British party extended the search to the northwest.

In three small vessels, Martin Frobisher and his crew crossed the North Atlantic in 1576 to discover the bay in southern Baffin Island which now bears his name. Unfortunately, a false rumour of gold arose on his return, and trips in the next two years seeking this mineral accomplished nothing new in the way of discovery—nor in riches Frobisher encountered the Eskimo, but his relations with these people were not friendly. John Davis, who was sent out by the merchants of London seven years later, was more fortunate, and reported the natives of Cumberland Sound "tractable and void of craft or double dealing". In two later voyages Davis penetrated as far as latitude 72° in Baffin Bay, examined the coasts, and noted openings as far south as Labrador.

The earlier explorers were deceived by the season for navigation in the Arctic. They usually arrived in early June, had a great deal of trouble with ice, and the crews were anxious to be home by the end of July. It was many years before they learned that the ice did not clear from the Arctic Islands until July, leaving August and September as generally ice-free months for travel. Henry

Photos by the authors unless otherwise credited.

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Left: Canadian Arctic regions (general place-name map)

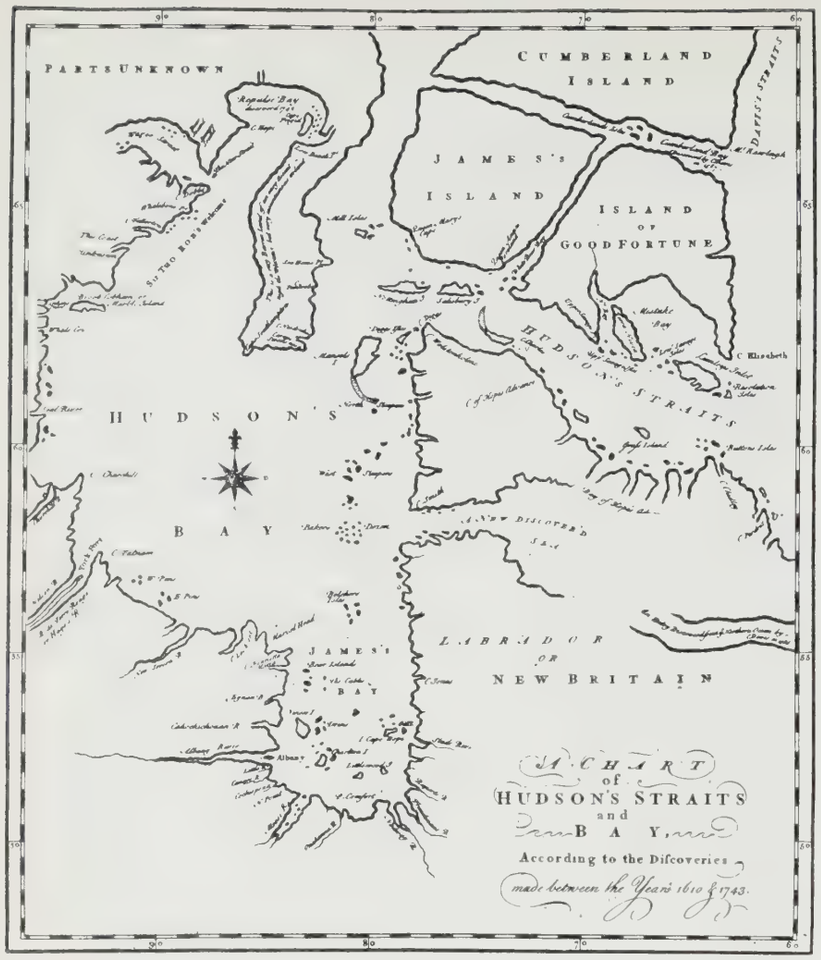


Chart of Hudson's Straits and Bay according to the discoveries made between the years 1610 and 1743.

Hudson was one of the explorers who did not learn this fact during his early voyages in northern regions. The story of Hudson's last voyage in 1610 is well known. His own account ends with his entry into the great bay named after him. The story of wintering in James Bay, and the account of mutiny the next spring comes from Abacuk Prickett, one of his crew, who tells how Hudson, his young son, and the least able-bodied or most loyal members of his crew were set adrift in a small boat in June, 1611, never to be seen again. In the following year, Sir Thomas Button, with Prickett and Robert Bylot (another member of Hudson's crew) again entered Hudson Bay, and, after touching Southampton Island, wintered at the mouth of the Nelson River, where many of the crew died. In 1615, Bylot and William Baffin took the bark *Discovery* on her fourth trip into Hudson Bay and travelled along the Foxe Basin coast of Southampton Island. This short expedition was on its way home early in August and reported unfavourably on the great amount of ice met in this region, not knowing that Foxe Channel usually clears of ice in August and September.

In 1616, Bylot and Baffin made the most notable voyage to date when they circumnavigated the whole of Baffin Bay, and noted Smith, Jones, and Lancaster Sounds, again at an early season, since they left the bay on August 6 (O.S.)*. Unfortunately, the discoveries of this voyage were doubted by the map-makers, and it was not until 200 years later that they were proved substantially correct. It might have been expected that Baffin's voyage would bring a renewal of the quest for a northwest route, but it was not until 1631 that another expedition came into the region. Two ships entered Hudson Bay in that year; one under Captain Luke Foxe travelled along the west coast of Hudson Bay from Roes Welcome Sound to James Bay and also touched the west coast of Baffin Island at Cape Dorchester on Foxe Channel. Foxe's erroneous latitude for Cape Dorchester stayed on our maps for 300 years due to the inaccessibility of western Baffin Island. The other voyage of that year was under the command of Thomas James, who achieved nothing but a scurvy and cold-ridden winter on Charlton Island in the bay named after him.

The failure of these two voyages to find a route to the Indies through Hudson Bay dampened interest in the search. A new quest arose, however. French-Canadian voyageurs had travelled northward from Quebec to Hudson Bay, and M. Grosseilliers, impressed by the wealth of furs in that area, endeavoured to promote interest in France in the Hudson Bay route. The French King had read Captain James' disparaging account and declined support, but the English Minister in Paris thought otherwise and introduced Grosseilliers to Prince Rupert of England. Thus, in 1670, the Hudson's Bay Company was formed, with princely backing.

For a period, now, discovery was neglected. Ships sailed into Hudson Bay year after year, but they were seeking cargoes of furs and not illusive routes to the unknown northwest. The company prospered and expanded, but its monopoly irked other English merchants, and one named Arthur Dobbs challenged that "The Company avoided—making discoveries to the northward of Churchill—for fear that they should

discover a passage to the western ocean and tempt by that means the rest of the English merchants to lay open their trade".

Dobbs engaged Captain Middleton to command an expedition which reached Repulse Bay in 1742, and reported a "Frozen Strait" to the east and no hope of passage up Roes Welcome Sound. Dobbs refused to believe this and discredited the unfortunate Middleton by accusing him of accepting bribes from the Hudson's Bay Company. An aroused Parliament offered a reward of £20,000 to the discoverer of a northwest passage, but this offer stood for the next hundred years.

Little progress in exploration was made in the Eastern Arctic during the latter part of the eighteenth century. (*1*) Wager Bay was explored to its head in 1747, and Chesterfield Inlet in 1762. Farther north two naval parties entered Baffin Bay but not beyond. On the mainland, Samuel Hearne of the Hudson's Bay Company travelled overland from Churchill across the Barren Grounds to the Arctic coast near the Coppermine River in 1771-72; and Alexander Mackenzie of the Northwest Company, in 1789, paddled down the great river named after him and also reached the northern coast.

Second Period—1818–1855

It is worthwhile reviewing the state of knowledge of America's Arctic coasts in 1818 as shown on maps of that time. Bering Strait was known as far as Icy Cape in Alaska, but, to the east, the coastline was merely a dotted line for eighty degrees of longitude to a point near Repulse Bay, with only two known localities indicated, "the Sea according to Hearne" and "the Sea according to Mackenzie", both as accurate as might be expected. The opening of Foxe Basin was east of Repulse Bay, its northern limits undefined, and Baffin Island was completely divided into three islands by Cumberland and Frobisher "Straits", which were thought to be continuous passages of water. Northwest of Baffin Island and north of the 70th parallel was blank. (2)

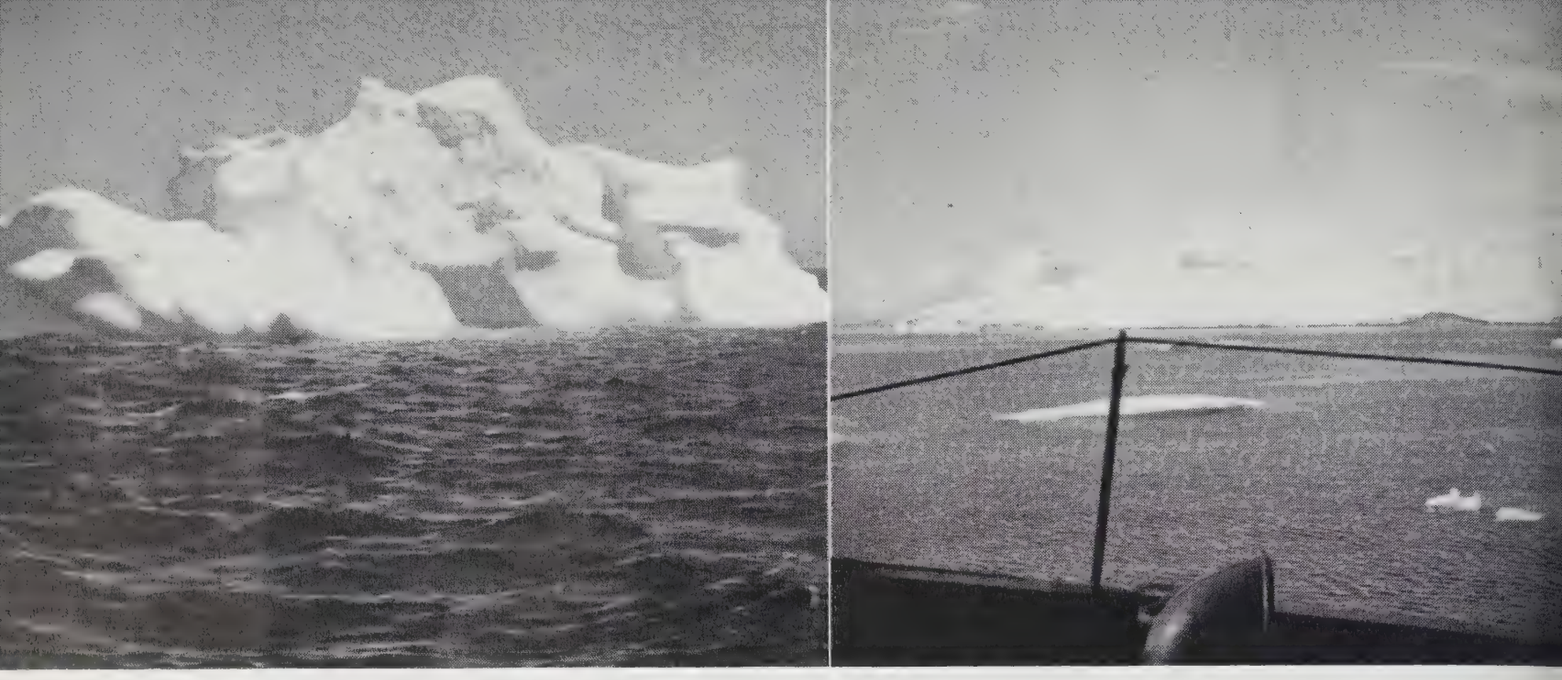
The end of the Napoleonic Wars found the British Navy triumphant, manned by experienced sailors, and well outfitted to continue the search for a northern route through the sea reported north of America. Many famous names occur from year to year, (3) and serving on the four ships which sailed in 1818 were John Ross, Edward Parry, F. W. Beechey, George Back and John Franklin. John Ross, accompanied by Parry, went to Baffin Bay, following the route taken by Baffin 200 years previously. He identified the latter's landmarks, but also regarded the three main sounds leading from Baffin Bay as closed inlets. Ross then sailed south along the northeast coast of Baffin Island, mapping carefully as he went and naming the capes and bays. Much of this coastline is still charted as this expedition reported. He reached Cumberland "Strait" by October 1, but the season was too advanced for further exploration and he did not enter this supposed passage. When Ross returned home, Sir John Barrow, Secretary to the Admiralty, and leading promoter of the renewed quest, accused him of negligence in investigating the sounds, especially Lancaster, and next year sent Parry to explore this route.

Edward Parry was undoubtedly one of the great Arctic explorers and navigators. (*4*) He developed a sound wintering technique which overcame both apathy and scurvy, and made spring sledge journeys which opened up new land territory. By this time ships had improved in size and strength, and

*O.S. Old Style Calendar. This should be August 16 by the present calendar.



Chart of the Eastern Arctic showing the extent of knowledge in 1662.



Icebergs off the Baffin Island coast

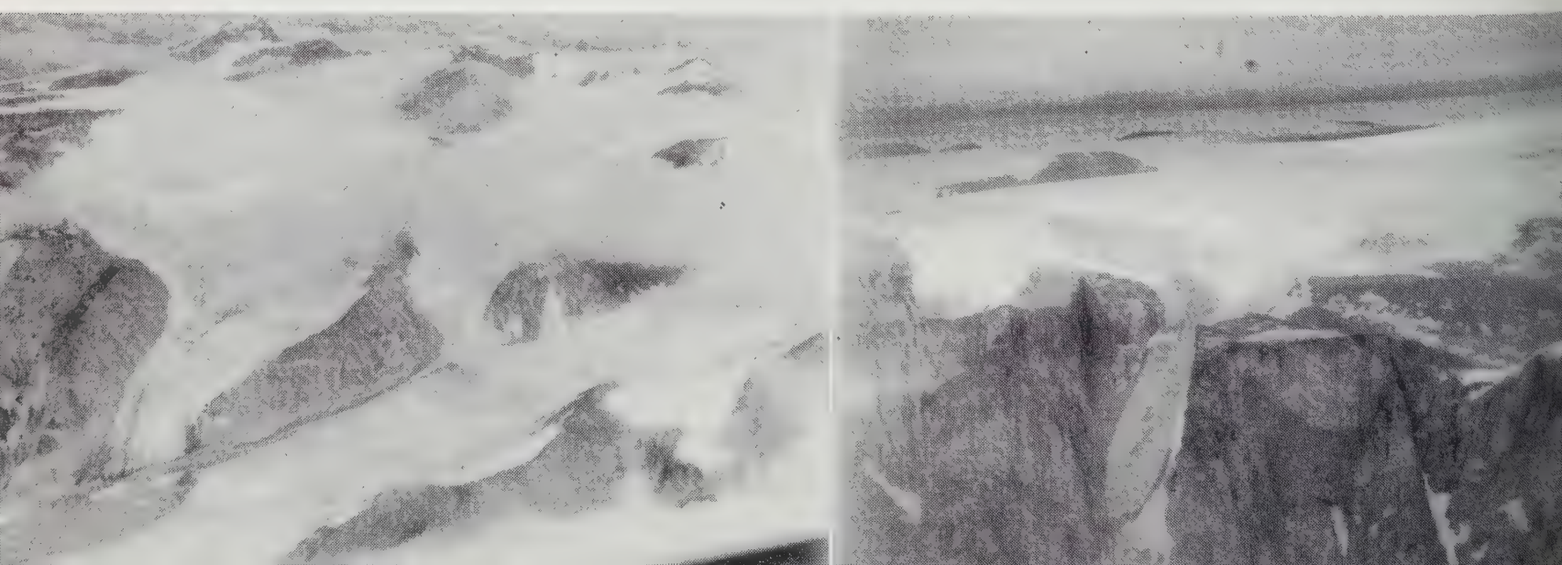
a whaling fleet of considerable size was then operating yearly in Baffin Bay. Despite these advantages, one of the serious problems which confused the early navigators was the unreliability of their magnetic compasses due to the proximity (then unknown) of the North Magnetic Pole on Boothia Peninsula.

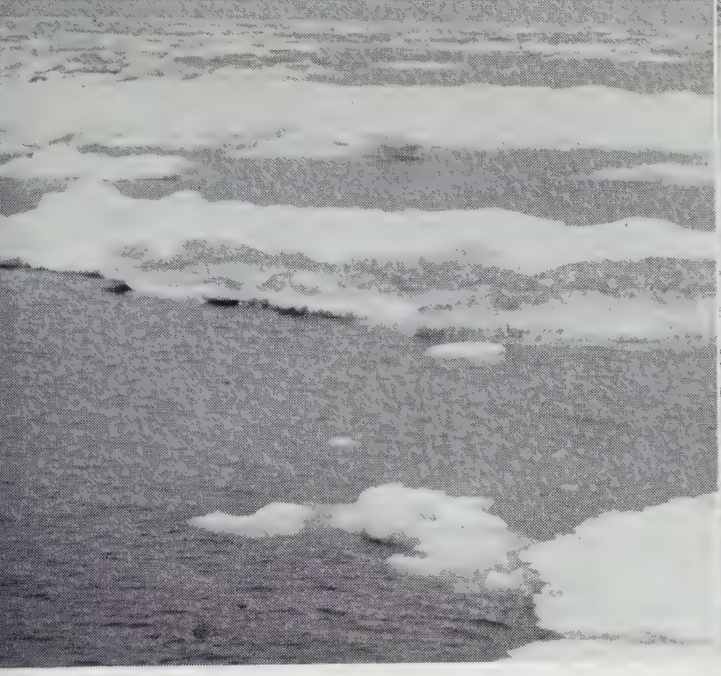
Parry's first voyage entered Lancaster Sound and reached Melville Island before wintering, thus winning £5,000 for the first crossing of the 110th meridian. Next season ice coming from the west prevented any further advance in the passage. In 1821, Parry attempted another route by entering Hudson Strait and followed the east coast of Melville Peninsula in Foxe Basin to Igloolik. Here, ice in Fury and Hecla Strait again blocked his progress. Parry spent two winters in this region and includes in his journals much of interest about the Eskimo of the Fury and Hecla Strait area. Parry tried a new route again in 1824 on his third voyage. After a difficult voyage across the North Altantic, he entered Prince Regent Inlet, south from Lancaster Sound, and wintered on the Baffin Island shore. He crossed the Inlet in July 1825, but the *Fury* was wrecked off Somerset Island, and both crews had to return home on the *Hecla*.

Further attempts by way of the Foxe Basin route also failed. In 1824, G. F. Lyon, who had been with Parry on his second trip, failed to make any new discoveries in the *Griper*, and Captain Back, who had already completed three great overland expeditions in the Mackenzie District, was also defeated by the ice in 1833. His ship, the *Terror*, was frozen in and spent nine months of winter drifting helplessly along the northeast coast of Southampton Island before being released in Hudson Strait in July.

Mountain peaks and glaciers of Cumberland Peninsula, north of Pangnirtung.

The ice-cap above the west wall of Pangnirtung Pass





Loose, scattered floes in Hudson Strait in mid-July.



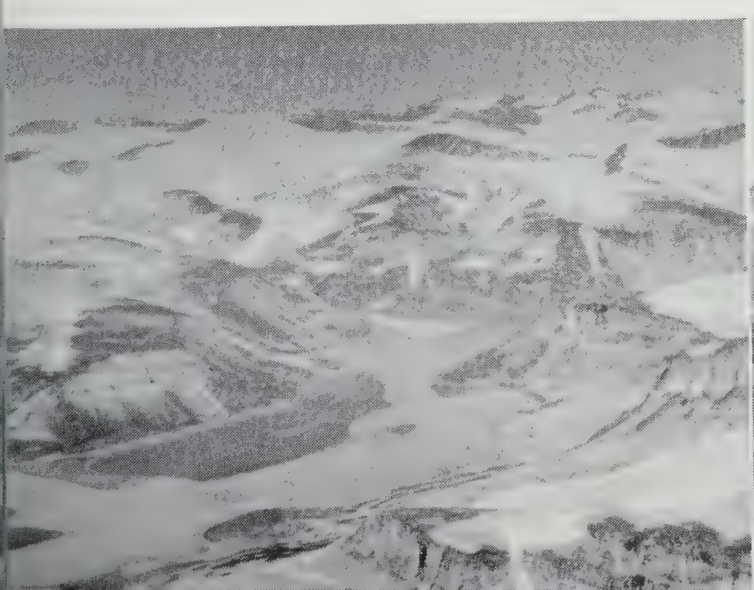
R.M.S. Nascopie surrounded by ice-floes in Eric Cove, Wolstenholme, in late July.

Meanwhile, John Ross renewed his Northwest Passage search in 1829. His ship, the 150-ton *Victory*, was powered by auxiliary steam, but the engine proved of little assistance. He entered Prince Regent Inlet easily in mid-August and renewed his supplies from the wreck of the *Fury* on Somerset Island. As he sailed south he missed the entrance to Bellot Strait, now marked by the trading post of Fort Ross, although he actually stopped at Brown Island at the mouth of the strait. Winter quarters were established at latitude 70 on the east side of Boothia Peninsula. Noteworthy winter travels were made by James Ross, the commander's nephew, who reached beyond the northerly point of King William Island, and later sledged to the site of the North Magnetic Pole. During the summer of 1830, John Ross was able to move his ship only three miles, and, in the following year, the ice remained fast about the vessel throughout the whole season. Ross abandoned the *Victory* in the summer of 1832 and moved to the northern end of Prince Regent Inlet in small boats. Moving ice again stopped them and the party returned to Fury Beach where they spent a fourth winter. The hardy crew moved again in 1833 and were finally picked up by a whaler in Lancaster Sound and taken back to England. Ross's voyage established the certainty of a peninsula extending north from the mainland of Canada and discouraged all hope of a passage through this region.

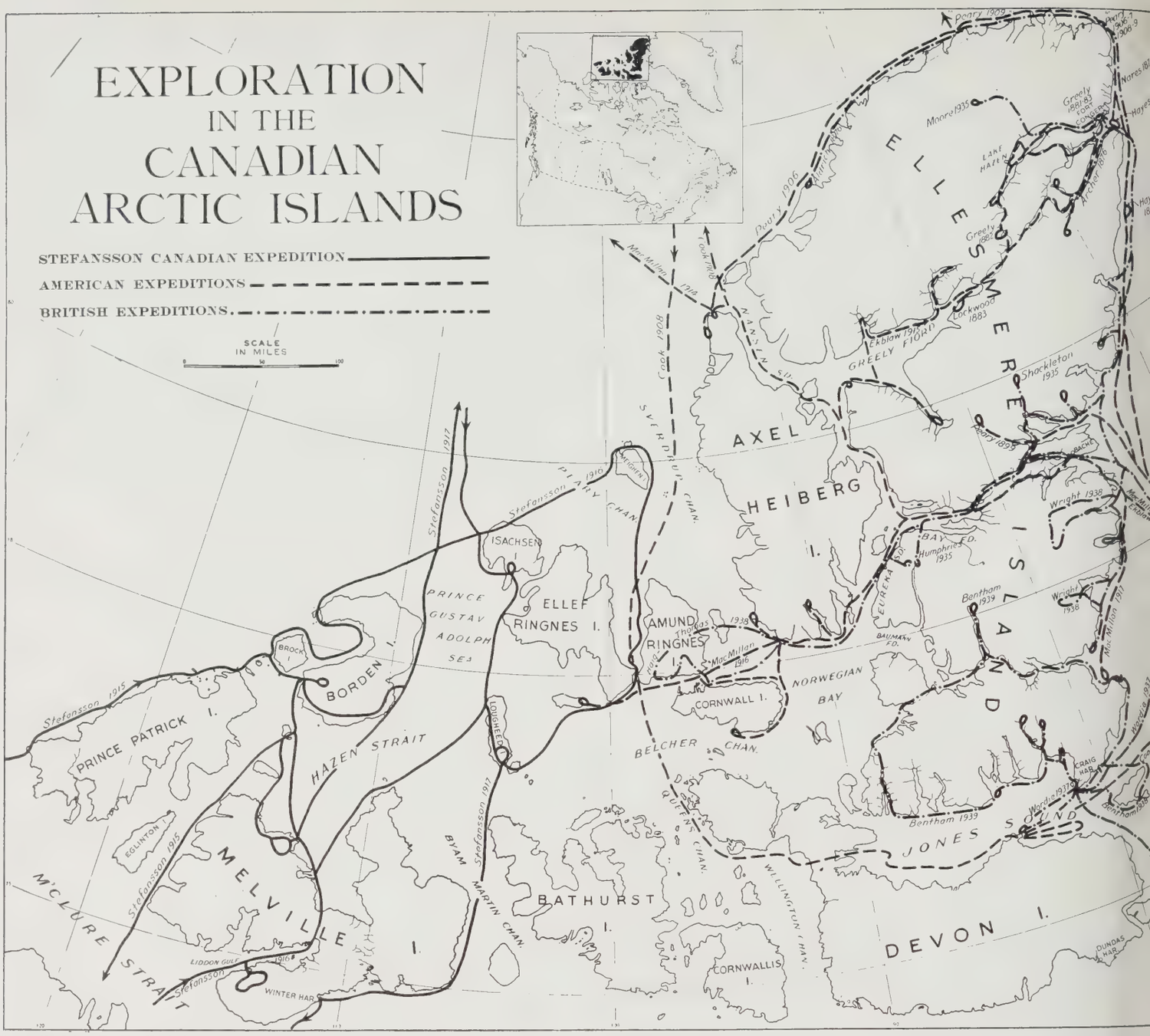
The next episode is the oft-repeated story of Sir John Franklin's tragic expedition of 1845, which disappeared south of Barrow Strait. (5) The important results coming from the Franklin expedition were achieved by the numerous parties which searched the Canadian Arctic for the unlucky Franklin.

Snow-capped mountains of Cumberland Peninsula, near Inglis Bay. Picture taken in August.

Typical mountain glacier flowing into Kingnait Pass, east of Pangnirtung. Photos by Eric Fry



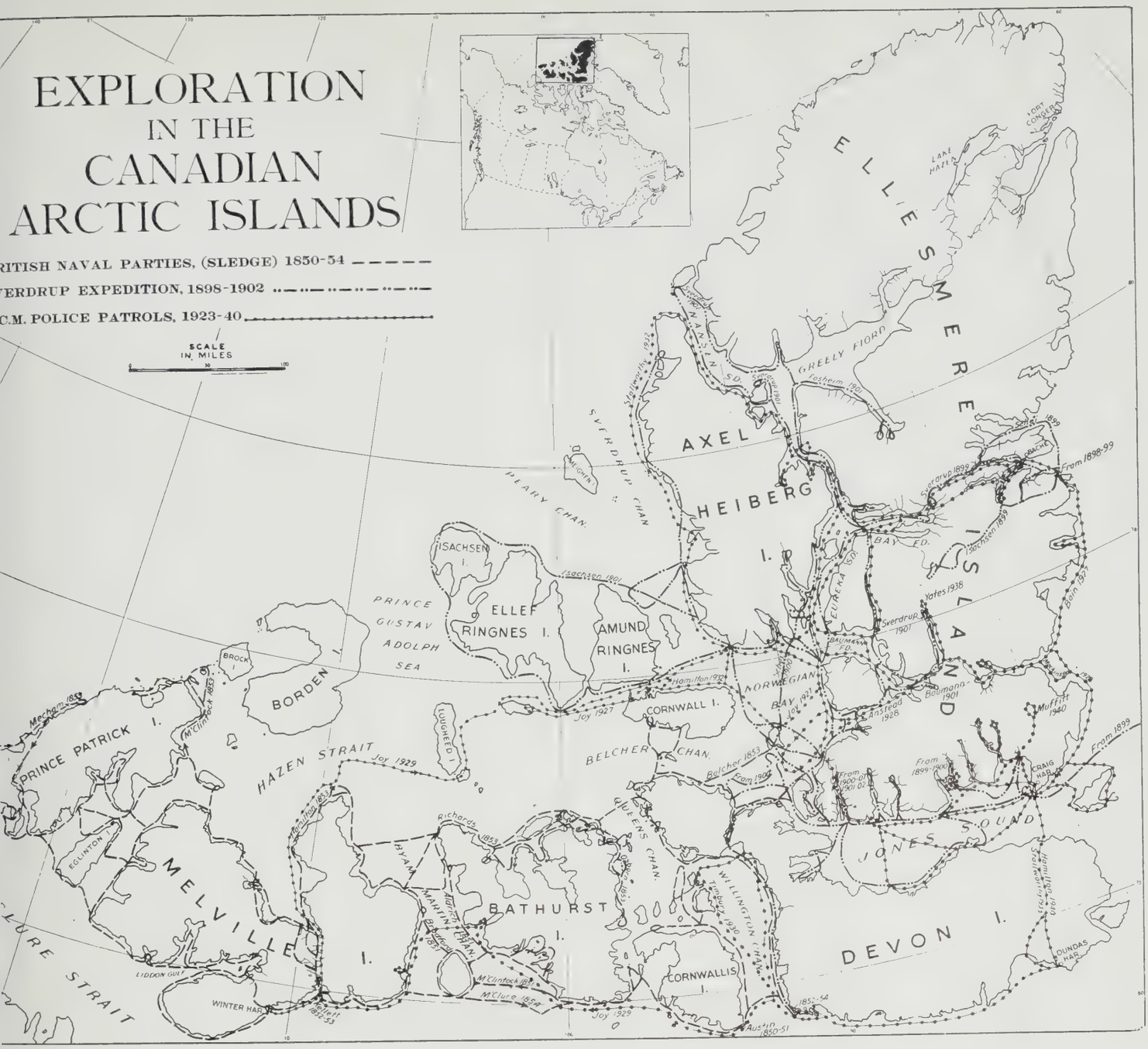




Exploration in the Canadian Arctic Islands (Stefansson, American, British)

It is estimated that 6,000 miles of new coastline were discovered in Canada's Arctic Islands; Smith Sound was penetrated as far as Kane Basin, and Jones Sound and Wellington Channel were explored. (See map p. 143). Many ships wintered in the Arctic and long sledge trips, totalling over 40,000 miles, were taken in spring when the land-fast ice linked the islands together. Occasional use was made of the dog-team, but most of these journeys were in regions where no natives lived, and the searchers developed their own technique of hauling their sledges by man-power. Of the many famous names of this period, now commemorated on the present maps of this area, Leopold M'Clintock was one of the most widely travelled. He crossed Melville Island and discovered Prince Patrick Island beyond, and, in 1859, it was he who returned from Bellot Strait with some definite news of the Franklin party's fate, verifying John Rae's clues.

A Northwest Passage was finally found when Captain Robert M'Clure, a member of Capt. Richard Collinson's Franklin search expedition, succeeded in travelling partly on foot and partly by sea from Bering Sea to the Atlantic. M'Clure entered the Arctic from the west in his ship the *Investigator* and disappeared north of Banks and Victoria Islands. After spending three winters with their ice-bound ship in Mercy Bay, Banks Island, M'Clure and his crew abandoned the *Investigator* and sledged to Dealey Island



Exploration in the Canadian Arctic Islands (British Naval, Sverdrup, R.C.M.P.)

where they met Capt. Kellett in the spring of 1853. Next spring they sledged eastward to Beechey Island and from there were taken by ship to England.

Third Period—1855-1914

The geographical information which resulted from the Franklin search expeditions brought the realization that there was no practical navigational route through the Arctic Islands. Fresh incentive to the penetration of the Eastern Arctic came from other sources—the competition to reach the North Pole, the whaling industry, and, finally, the interest of the Canadian Government in establishing sovereignty over the Arctic lands which she inherited from Britain. In the field of exploration one main avenue remained to be followed. This was the far northeastern area which became the route for polar expeditions culminating in Peary's final journey to the North Pole in 1909. (*6*)

United States' interest in the Eastern Arctic was roused by the journey of an American, Elisha Kane, into Kane Basin in 1853 while engaged in the Franklin search. Dr. Hayes, Kane's surgeon, returned to the Arctic in 1860 and, after wintering on Greenland, explored sections of the Ellesmere Island coast. In 1871, C. F. Hall, who had had previous Arctic experience in the Frobisher Bay and Repulse Bay areas, was encouraged by the United States Government to reach the Pole by this route. His



Eskimo dog-team and komatik, Lake Harbour, Baffin Island

vessel, the *Polaris*, reached latitude 82° before returning to winter quarters, where Hall's death ended the expedition.

The British Government took up the challenge of the Pole and, in 1875, dispatched a powerful expedition under Captain Nares to explore the Ellesmere Island route. A valuable series of papers on past Arctic experiences and methods was compiled for this expedition, but many of the lessons were not heeded. (*7*) Sledges were still man-hauled and scurvy took its toll. Nares' ship, the *Alert*, went into winter quarters 15 miles north of Hall's "farthest north" at the edge of the Polar Sea. His sledge parties reached 83°20′ in the direction of the Pole, and explored the whole northern shore of Ellesmere Island. (See map p. 142).

In 1881, the first Polar Year, a world-wide organization of northern stations was set up by various co-operating nations. The United States made a major contribution when Lt. Greely established a base at Fort Conger on northern Ellesmere Island. Journeys made from here included a "farthest north" on the Greenland coast and a crossing of Ellesmere Island to Greely Fiord. When the relief ships failed to get through the pack-ice after the second winter at Fort Conger, Greely's party made a disastrous retreat to Cape Sabine, near Bache Peninsula, where, in the summer of 1884, only seven survivors were picked up.

The Norwegian expedition under Otto Sverdrup made the largest new discoveries in the far northern Arctic Islands in 1898 to 1902. (*8*) Using the *Fram*, in which he had previously drifted across the Polar Sea with Nansen, Sverdrup spent four winters in different harbours in Ellesmere Island. His expedition mapped much of the western coast and discovered several large islands and many small ones, now called the Sverdrup Group, west of Ellesmere Island. The Norwegian flag was raised in this area, and it was not until 1930 that the Norwegian Government formally acknowledged Canadian sovereignty over the islands in question.

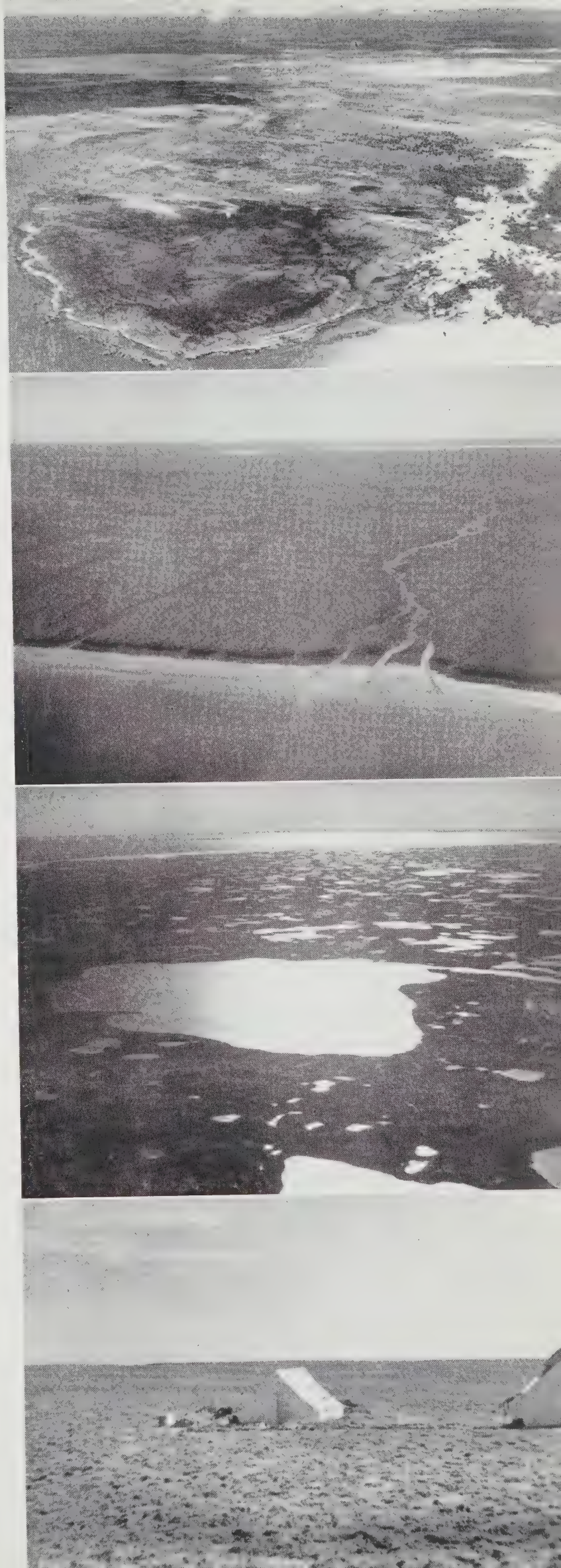
The remainder of this period's story of far northern exploration deals with the Peary-Cook struggle to reach the North Pole first. (*9*) This Arctic controversy need not be revived and regardless of whether either was successful, Robert Peary certainly deserved the attainment of his goal. Peary's several attempts, reaching farther each time, his brilliant tactics in travel by Eskimo methods—dog-teams, igloos and fur-clothing, all bring great credit to him as an Arctic explorer.

Although the spirit of pure exploration extended our knowledge of far northeastern Canada, it was commerce and government which helped to fill in many of the blanks farther south. In the early part of the nineteenth century, the whaling industry had shifted from the Greenland Sea to Baffin Bay. (*10*) As the value of whale-oil fell, that of whalebone increased until it reached $10,000 a ton in 1900, and a single whale yielded a season's profit. The right whales were hunted to near extinction, and, by the 1880's, the number of whalers was declining. The end came in 1905 when a substitute for whalebone was invented. The whalers came mainly from two local areas: the ports of Scotland and from New England. Their methods were rather different: the Scottish whalers had larger vessels, later steam-powered, and usually completed their operations in a summer season in Baffin Bay; the Americans used small schooners and soon developed a practice of wintering in Hudson Bay to obtain early season fishing before Hudson Strait was navigable.

In 1860, the first two American whalers wintered in Hudson Bay, and the next decade was a period of great activity for the industry in this region. The whalers manned some of their small boats with Eskimo and traded with them during the winter, so that their impact on native life was considerable. As whaling declined, many of the old timers remained as traders. Captains Comer, Mutch, and Murray are names that are well known in the Eastern Arctic, and, after the Great War, the Hudson's Bay Company employed some of the old whaling skippers as post managers in their newly opened trading posts.

Regular winter whaling stations were also operated in Cumberland Gulf until the early years of this century. Those of Kekerton and Blacklead Islands were eventually taken over by Mr. Crawford Noble of Aberdeen, and the owner's son made a few inland hunting trips which provided an early knowledge of the interior of Baffin Island. Kekerton was the headquarters of the famous German (later American) anthropologist, Franz Boas, who did the field work, in 1883-84, which established his reputation as a great authority on the Eskimo. (*11*) Blacklead Island was the scene of the first Anglican missionary establishment, founded by Dr. E. J. Peck in 1894, and was also the base for Bernard Hantzsch, the German explorer who travelled across Baffin Island and died on the unknown west coast in 1911. (*12*)

In 1880, the young nation of Canada awoke to the fact that her northern boundaries were vaguely defined. Accordingly, at her request, the British Government confirmed the transfer to the Dominion of all the Arctic Islands adjacent to the Canadian mainland. The view of international law is that title to lands cannot rest solely on discovery, but must be followed by some



First aerial pictures of recently-explored west coast of Baffin Island

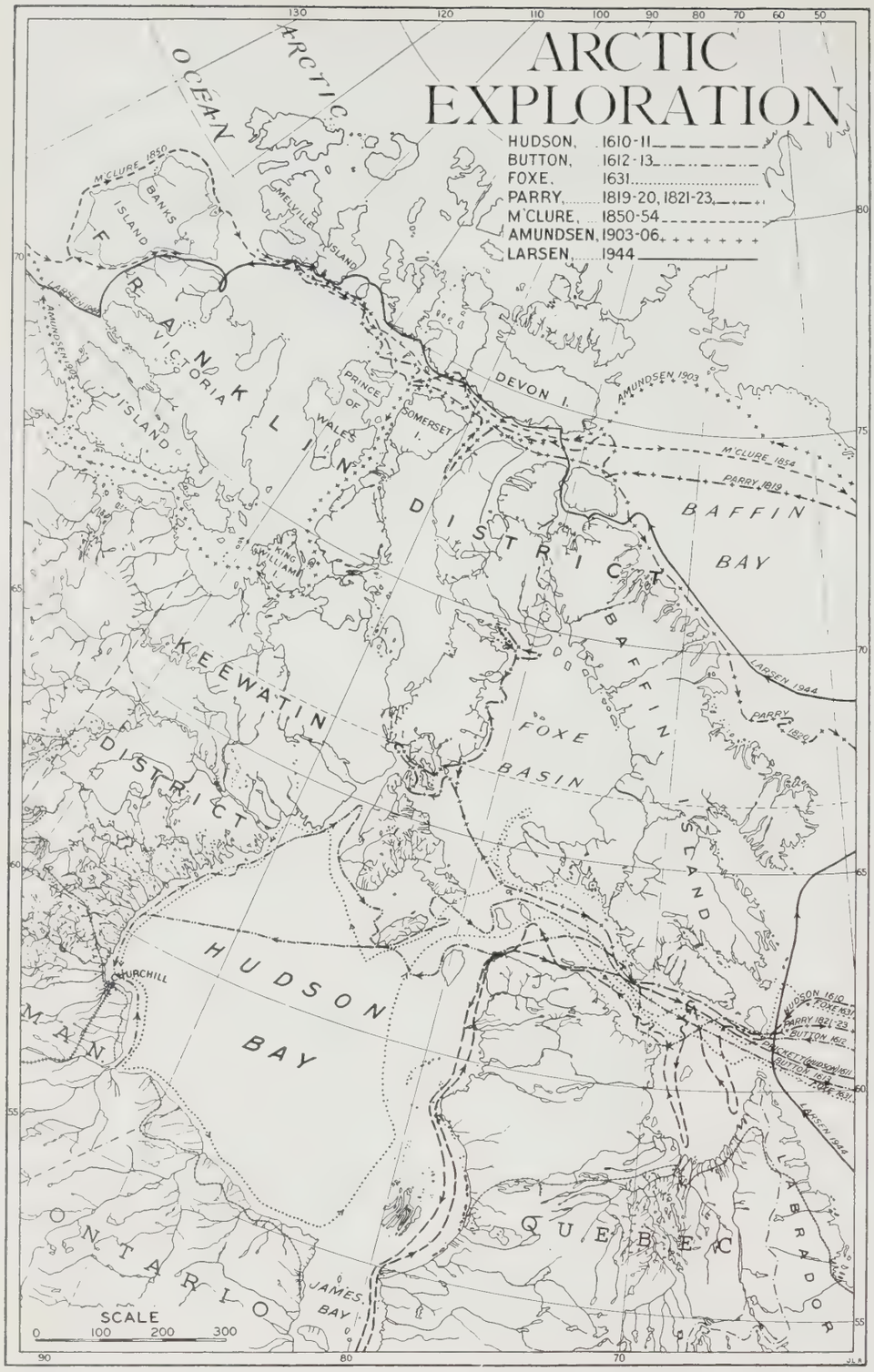
Top to bottom:
Low, rocky interior east of Nettilling Lake
Stranded ice-blocks dot the shallow shore.

Low, swampy coast south of Koukjuak River, western Baffin Island

Looking southeast across the lake-dotted plain towards Nettilling Lake.

Topographical Survey camp on grassy tundra plain near Amadjuak Lake

Photos by John Carroll



Arctic exploration (routes of seven Arctic explorers)

kind of occupation. Canadian expeditions which asserted and maintained this sovereignty were soon sent out by the Canadian Government.

The first Dominion parties were concerned with the investigation of the Hudson Bay route. Sea-borne expeditions went north to Hudson Strait in 1884, 1885, and 1886, and maintained meteorological stations at several points during the two intervening winters. Dr. Robert Bell, of the Geological Survey, investigated geology during the first two of these trips, one of which discovered the lofty Ottawa Islands off the east coast of the Bay. The reports of the expeditions suggested a certainty of navigation through the Hudson Bay route from the first week in July until the first week in October, and the commander recorded preference for Churchill over Fort Nelson as a terminal for the projected railroad to Hudson Bay. In 1897, the *Diana*, under Commander Wakeham, was sent to investigate earlier and later dates for navigation and, with Mr. A. P. Low, of the Geological Survey, collected specimens of fish and plankton. (*13*) The next government expedition was the first of several wintering parties in the *Neptune*, commanded by A. P. Low. This party spent the winter of 1903-04 at Cape Fullerton, a long-frequented whaling station northeast of Chesterfield, and the following summer sailed to Ellesmere Island, and Beechey Island, in Barrow Strait. (*14*)

In 1904-05, the *Arctic*, under Captain J. E. Bernier, wintered at Cape Fullerton with a Royal Northwest Mounted Police detachment (now R.C.M.P.). In 1906, a series of three wintering expeditions was started in this famous vessel under the same commander. Winters were spent at Albert Harbour (near Pond Inlet), Winter Harbour (Melville Island), and Arctic Bay (northern Baffin Island). The first of these voyages was almost wholly concerned with asserting sovereignty and little scientific work was accomplished. On the second voyage, 1908-09, the geology of Melville Island was studied by J. G. MacMillan and biological collections were made. Winter journeys included one on foot across M'Clure Strait to Banks and Victoria Islands. (*15*) On the third voyage J. T. E. Lavoie investigated the geology of Brodeur Peninsula and made two long journeys by dog-team; one down Admiralty Inlet, and the other to a point

north of Agu Bay on the Prince Regent Inlet coast. The *Arctic* called at Pond Inlet on her outward voyage, and one of the ship's officers reported a discovery of gold. This unfounded rumour caused three schooners and parties to return next year (1912) to prospect, one of them commanded by Captain Bernier. Although no gold was found, the first white crossing of Baffin Island in this area was made by A. Tremblay with two Eskimo companions when he sledged across to Igloolik.

On the west side of Hudson Bay, exploratory mapping and reconnaissance geology was done at the turn of the century by the Tyrrell brothers, J. W. and J. B., of the Geological Survey of Canada. (*16*) The Western Arctic was linked with the eastern region in 1903-06 when R. Amundsen finally accomplished the Northwest Passage by sea in one vessel, the small 47-ton *Gjoa*. The Western Arctic regions of the mainland and archipelago were given further attention when several Canadian scientific and exploratory parties did valuable work under the leadership of V. Stefansson, 1908-12 and 1913-18. No further Dominion Government expeditions were sent to the Eastern Arctic until after the first Great War.

Fourth Period—1914 to Present

Within the modern period the character of expeditions to the Eastern Arctic has changed. Pure exploration, which added new lines to the map, has yielded place to a more detailed scientific search for knowledge. The outline of developments in recent years will thus be given a different treatment to illustrate scientific achievements and point out the scope for future studies. (*17*)

Recent investigation of the Eastern Arctic has been aided by the fact that a small permanent white population came into the region within this period and was serviced by dependable water transportation. The Hudson's Bay Company had been sailing ships through Hudson Strait for over 200 years before they finally established trading posts there. Beginning in 1909 at Wolstenholme, the Company began pushing the trading business with Eskimo and soon had posts scattered throughout the Eastern Arctic. In 1912, the icebreaker *Nascopie* first entered the Eastern Arctic to carry supplies to the H.B.C. posts. Since then the sturdy ship has become an important part of the history of the region. In 1933, the *Nascopie* was chartered to transport the annual Canadian Government Eastern Arctic Patrol and continues to fulfil this dual role. The Royal Canadian Mounted Police also moved farther north and opened detachments at Pond Inlet and Craig Harbour in 1922. Additional detachments were established at Pangnirtung, in 1923, Dundas Harbour and Fram Haven in 1924, and the latter shifted to Canada's most northern post on Bache Peninsula, Ellesmere Island, in 1926. Meteorological stations under the Canadian Department of Transport have also been located at several of the Arctic centres. (*18*) Missionaries entered the Eastern Arctic to convert the Eskimo. The establishment of an Anglican mission in Cumberland Sound was previously noted, and the organization has



Routes of Eastern Arctic Patrol, Topographical and Geodetic Surveys



The sharp, snow-covered peaks of the north coast of Bylot Island. Note the broad glacier on the right.

expanded, now having eight mission stations. The Oblate Fathers of the Roman Catholic Church also extended their missionary work to the Eastern Arctic and have ten mission centres.

The size of modern expeditions has greatly decreased. Frequently one finds a small group of men skilled in their own pursuits, or an individual with a special line of research, visiting the Arctic for a single summer season, or for several years at a time. It is believed that the best scientific work can be done by wintering parties—not because of the winter, in which little activity except mapping is possible—but because men are on the ground in spring before navigation of the seas begins, and ready to take advantage of the snow-free ground and the biologically fruitful period.

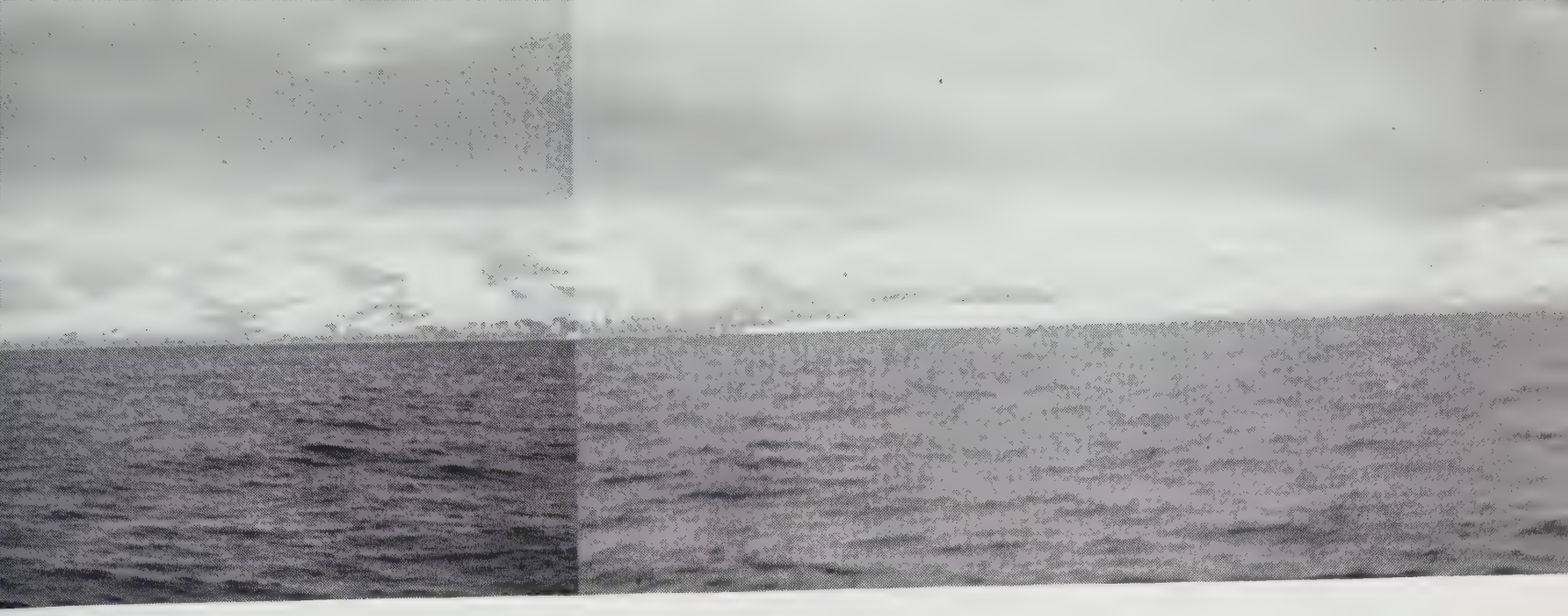
Two of the special exploratory and scientific parties which have increased our knowledge of the Eastern Arctic should have special mention, although their scientific results will be detailed later. One was the well-organized, excellent Danish Fifth Thule Expedition, which spent the years 1921-24 in the Canadian Arctic under the able leadership of Knud Rasmussen. (*19*) The other was organized by T. H. Manning, a young British scientist, with previous Arctic experience on Southampton Island, to explore the Foxe Basin area beginning in 1936. Many new discoveries and valuable data were brought out by this party and by individuals of the expedition who returned to the area later. (*20*) Manning remained in the region after his expedition finished its work in 1937 and, accompanied by his wife, continued his explorations in western Baffin Island until 1941.

Numerous summer expeditions have entered the Eastern Arctic by ship, accomplishing reconnaissance work on trips covering a large area with limited halts. Such has been the characteristic of the annual Canadian Government Eastern Arctic Patrol which was inaugurated in 1922 to oversee the Eskimo population and has expanded in the last decade to include a scientific personnel. (*21*) Many scientists from various fields have accompanied the patrol to the Arctic posts and have been able to do useful work in their short periods ashore. Other cruising expeditions have been led by J. M. Wordie in 1934 and 1937, and several American parties have travelled by schooners under the command of Captains Robert Bartlett and Donald MacMillan, both former lieutenants of Peary.

After centuries of attempts and failures, the dream of navigating the Northwest Passage in one vessel during a single season was finally realized in 1944 by Sub-Inspector Henry A. Larsen in the Royal Canadian Mounted Police schooner, *St. Roch*. The sturdy little patrol vessel left Halifax in July, 1944, sailing north around Baffin Island and went through Lancaster Sound to Melville Island and thence south through Prince of Wales Strait into Amundsen Gulf. From there the *St. Roch* continued along the Arctic coast around Alaska and arrived in Vancouver in October, completing the history-making voyage in 86 days. Previously, in 1940-42, the 80-ton R.C.M.P. boat had been the first ship to make the passage successfully from west to east, but had been forced to winter at Walker Bay, Victoria Island, and on the west coast of Boothia Peninsula, before continuing through Bellot Strait to Lancaster Sound. (*22*)



The C.G.S. Arctic beset by ice off Baffin Island, July, 1925.



Mapping

It is now considered unlikely that any large new discoveries of land will be made in the Canadian Arctic sector. Additions and corrections to the existing coastline can always be made by small-scale surveying parties, but it seems likely that aerial photography aided by specialized ground-control parties will more rapidly fill in the details for future Arctic maps.

Several important modifications have been made in the present maps within the modern period. In southern Baffin Island, the work of J. D. Soper and the Putnam expedition of 1927 has altered the outline and filled in some detail of Foxe Peninsula. (*12*) The fiord region of eastern Baffin Island north of Cape Hewett was surveyed in part by two Cambridge expeditions of 1934 and 1937. The remaining unseen west coast of the island was finally mapped by T. H. Manning from 1938 to 1940. On Ellesmere Island and parts of the northern Archipelago, small additions to the map have been made by parties under Edward Shackleton in 1935 and David Haig-Thomas in 1937. The extensive Royal Canadian Mounted Police patrols, of which those of the late Inspector A. H. Joy were most notable, have also added new information. (See map p. 143).

More precise work has been carried out recently by official Canadian Government parties. C. H. Ney of the Geodetic Survey, on trips with the Eastern Arctic Patrol ship and auxiliary vessels, has accurately fixed the position of most of the posts and surveyed local sections. Since 1942 the Geodetic and Topographical Surveys have had several parties in the field spreading the ground-control points for future aerial photography. They have fixed positions in the interior of Keewatin District, northern Quebec, both coasts of Hudson Bay, and southern Baffin Island. (See map p. 147).

Geology

The main geologic features of the Eastern Arctic have been uncovered by geologists accompanying the various exploratory expeditions over many years. This information has been assembled by the staff of the Geological Survey of Canada, and will be incorporated in a new geological map of Canada, which will contain the best data available about the general geology of the Eastern Arctic.

Detailed geologic work has been done in only a few scattered places and further investigations may be profitable in several areas where there are known mineral possibilities. (*23*) Prominent workers in recent years have been L. J. Weeks (Cumberland Sound, 1926, and west coast of Hudson Bay, 1929-30), I. H. Cox (Akpatok Island, 1931), H. C. Gunning (east coast of Hudson Bay, 1933), and R. Bentham (southern Ellesmere Island 1936-39). The kindred subjects of geomorphology and glaciology have been



The old and new in Arctic transportation, Coppermine, 1931

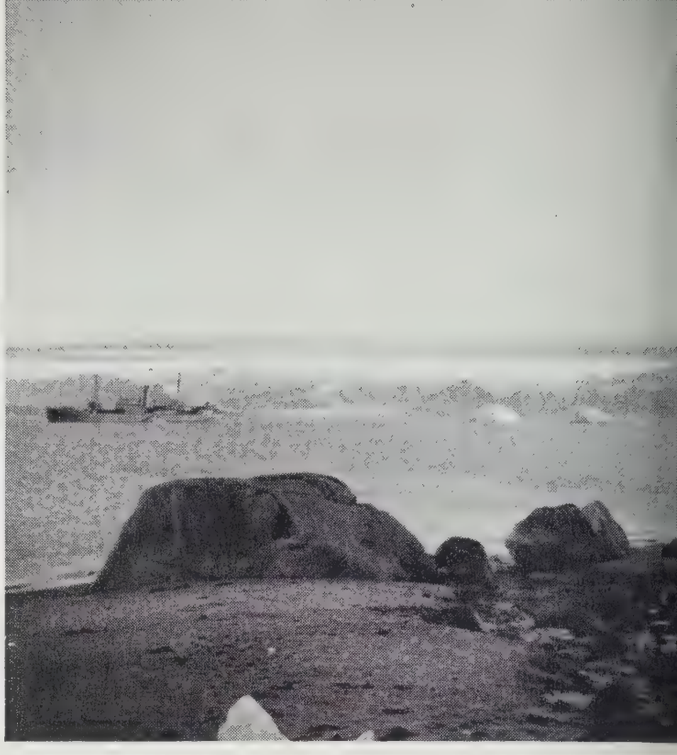
studied by D. A. Nichols of the Topographical Survey during a series of trips on the Eastern Arctic Patrol, but much still remains to be known about the position and extent of the remnants of the Pleistocene ice-sheet which occupy areas in Baffin, Devon and Ellesmere Islands. (*24*)

Magnetism

The position of the North Magnetic Pole within the Eastern Arctic makes the study of magnetism an important one in this region. Notable work has been done by the Geodetic Survey of Canada and the Carnegie Institute of the United States. Dominion Government expeditions noted terrestrial magnetism effects in Hudson Strait in 1912, and from 1927 onward. In 1937, R. G. Madill of the Dominion Observatory carried out researches while a member of the Eastern Arctic Patrol, and the recent survey parties fixing ground-control points have added a great deal of new information concerning magnetic delinations and variations. The Carnegie Institute was behind Donald MacMillan's wintering trip to southwest Baffin Island in 1921-22, and, in recent years, has established an ionosphere station on another part of this island.

Botany

The botany of the Eastern Arctic has been well summarized by Nicholas Polunin in a booklet published by the National Museum of Canada. (25) In it he lists about 300 vascular species found in the Eastern Arctic and includes a useful history and bibliography.



R.M.S. Nascopie at anchor in Pond Inlet. The mountains of Bylot Island are twenty miles away in the background.

Botanical collections have been made by several expeditions. The one collected by the botanist on the Norwegian *Fram* expedition, 1898-1902, was one of the most important in the Far North. On Baffin Island, the work initiated by Dr. R. Bell in the last century has been ably continued by J. Dewey Soper and others. At points touched by the Eastern Arctic Patrol, plant specimens were gathered by the late Dr. M. O. Malte of the National Museum, who correlated most of the known information concerning the botany of the Eastern Arctic. On the western side of Hudson Bay extensive collections were made by the Canadian Government botanist J. M. Macoun, in 1910, and supplemented by later work of A. E. Porsild of the National Museum.



Rugged east coast of Bylot Island. Grounded iceberg on left and glacier from interior ice-cap on right



Akpatok Island rises as a flat-topped limestone block sheer above the ice-filled waters of Ungava Bay. Photo by John Carroll

Tides and Currents

There is an unfortunate lack of data concerning the movements of tides and currents in the Canadian Arctic Islands. Other than the 1908-09 record of the *Arctic* at Winter Harbour on Melville Island, very little is known about this natural phenomenon in the North. Future investigations, to supplement that done by the Russians on the Eurasian side of the Arctic Ocean, will aid in extending the world picture of tidal movements. Although most marine expeditions have reported on surface currents in the main straits of the Arctic, little is yet known about deeper ocean movements.

In Hudson Bay and Strait, research into oceanographical problems was carried on by the Department of Marine as well as the previously mentioned expeditions investigating the Hudson Bay route. In Davis Strait and Baffin Bay valuable data was gathered by the United States Coast Guard ship *Marion*. Its report accurately summarizes our present knowledge of currents and sea-ice conditions, including the movements of pack-ice and bergs. (26)

Marine Life

It is well known that the northern seas are rich in marine life but studies of habits and distribution have been curtailed by the inaccessibility of the region. Many of the expeditions have studied the larger sea mammals, but, because of the importance of these animals in the lives of the Eskimo, there is much more yet to be learned.

The possibility of commercial fish in Hudson Bay was investigated thoroughly in 1930 by an expedition of the Department of Fisheries, but none were found in quantity. A similar study of Baffin Bay should prove of some economic value. A report on the habits and kinds of fish found in the Eastern Arctic was submitted by H. M. Rogers who accompanied the patrol in 1937. Of basic importance to the study of habits and movement of seals have been the notes on plankton and food of seals, taken by M. J. Dunbar while a member of the patrol in 1939 and 1940. (27) Further investigation in this field may explain a great deal concerning the mystery of seal migrations.

Mammals

The mammals of the Eastern Arctic are of supreme importance to the human economy of the district and their distribution and



The "land" is chiefly water along the low, flat, west coast of Hudson Bay. Looking inland from near Tavani.





Fort Prince of Wales, near Churchill. Built by the British in 1734. Captured and partially destroyed by a French fleet in 1782.

Settlements in the Eastern Arctic

Left, top to bottom:

Cape Dorset, southern Baffin Island

River Clyde, eastern Baffin Island

Eskimo Point, west coast of Hudson Bay



Looking northward over mouth of Churchill River. Railway yards and Harbour's Board building of Churchill in foreground. Historic Fort Prince of Wales in distance





Looking southward over the town of Churchill, Manitoba.



conservation have been dealt with by publications of the Northwest Territories Administration. (28) Whereas nearly all expeditions have collected and observed mammalian life, the most important contributions to our knowledge have come from independent investigators sent out by the Dominion Government. They not only collected widely themselves but have included in their publications the results of other scientists who had visited the same areas.

The two most important of these special studies have been the work of C. H. D. Clarke and W. H. B. Hoare in the Thelon district of the northern mainland from 1928 to 1937, (29) and of J. D. Soper in southern Baffin Island from 1924 to 1930. (*30*) These reports, together with material assembled by R. M. Anderson in the booklet *Canada's Eastern Arctic*, give a useful summary of the species and distribution of mammals in the region. Ecological studies of certain animals have been conducted by means of a questionnaire on caribou and another on the white fox. The latter questionnaire includes animals related to the fox and its cycle such as the lemming, snowy owl, and dog. These results have been correlated mainly through the efforts of Dennis Chitty of the Bureau of Animal Population, Oxford University, who initiated the research in 1935 under the direction of Charles Elton. Smaller but important investigations have been made on Southampton Island by Sutton and Manning, and the latter has expanded the knowledge of Baffin Island's fauna by his journeys on the hitherto unknown section of the western coast. (31) The field notes of Peter Freuchen of the Fifth Thule Expedition provide information on the habits of animals in the North, and Magnus Degerbol also gives systematic notes on the results of this expedition.

Birds

The abundant bird life of the Eastern Arctic has always proven attractive to scientists, and much information is now at our disposal. The biological investigators sent out by the Dominion Government have again provided the most material, but countless small-scale collectors on every expedition, and local inhabitants such as L. A. Learmonth of the Hudson's Bay Company, have also made their contributions. Most of this work has been summarized by P. A. Taverner, who himself was on the Eastern Arctic Patrol in 1929. (*28*) Several other ornithologists, including representatives of the Ontario Museum, have also accompanied the patrol in recent years. Sutton on Southampton Island contributed valuable data for a local area, and Bray, who was with Manning in 1936, also added notable collections from Southampton and from Igloolik. (*32*)

The search to find the nesting locality of two species of geese well known in their wintering grounds was one of the most interesting problems of recent years. The Blue Goose nests were finally discovered by J. Dewey Soper in 1929 on western Baffin Island after a personal search that extended over a period of five years. Next summer Sutton found a few Blue Geese nesting on Southampton Island and from native ev-



idence interpreted the location of a colony in the southwest of the island which was later investigated by Bray and Manning. The latter extended the known breeding ground of the Blue Goose on Baffin Island as far north as Taverner Bay, and they have been seen in recent years in summer still farther north on Bylot Island. The mystery of the Ross's Goose, which vanished northeast of Great Slave Lake in summer, was not solved until 1940 when Angus Gavin of the Hudson's Bay Company discovered it nesting along the Perry River. (33) The fact that Blue Geese were also noted breeding there indicates that their range is much greater than was previously thought. It is possible that this whole area of the northern Keewatin interior is a great reservoir of migratory bird life.

Records and collections from the Arctic Archipelago and central northern coasts are still scanty and much work remains to be done. Northern ornithology is hindered by the fact that proper field studies must be done in one place and at a time well before navigation is possible. In the past this resulted in the necessity of a previous wintering in order to be in the area. An increased use of aircraft in the Eastern Arctic, however, may permit the landing of ornithologists at their chosen area shortly before the arrival of the breeding species.

Archaeology

The study of the native inhabitants of the Eastern Arctic began long ago with the first contacts by explorers. Of this group Captain Lyon was probably most sympathetic and made earnest attempts to study the language and customs of the Eskimo. More systematic work was done in the last century by Franz Boas, Lucien Turner, and Charles F. Hall. (*11*) The most thorough and extensive research was done by the Fifth Thule Expedition of 1921-24. Dr. Knud Rasmussen, the leader, himself part Eskimo from Greenland, spent three years traversing the northern shores of the continent, recording a wealth of folklore and customs at a lucky period just before the natives of this least accessible area began to be affected by encroaching white culture. (*19*) At the same time excavations done by Mathiassen of the Thule Expedition laid the foundation for later archaeological work in the Eastern Arctic.

Mathiassen's findings showed that the present Eskimo inhabitants of the Eastern Arctic were preceded by a people who depended much more on the larger sea mammals, especially whales, for their food, and who built stone and whale-bone houses. This type of culture has been called Thule in honour of the Danish expedition. (*34*) Subsequent investigators in the field, whose work has been correlated by Diamond Jenness of the National Museum, discovered a still earlier, and as yet little known culture, which is known as Dorset (the first specimens were brought to Major Burwash by natives at Cape Dorset, Baffin Island, in 1924). (*35*) Important sites of this culture have been located in Newfoundland by W. J. Wintemberg, in Hudson Strait by Douglas Leech-



R.M.S. Nascopie, historic Hudson's Bay Company icebreaker which also carries the annual Eastern Arctic Patrol.



A typical Department of Transport Radio and Meteorological Station, Arctic Bay, northern Baffin Island



Government doctor's residence on scenic Pangnirtung fiord

man—both of the National Museum, and at Igloolik by Graham Rowley. The exact origin of these people is still undetermined, but their artifacts are small and seem more suited to the hunting of land animals and smaller game than of larger sea mammals. Other recent archaeological efforts have come from R. Bentham in southern Ellesmere Island in 1938 and by G. I. Quimby in the Belcher Islands in 1939.

Much work remains to be done in the Arctic regions to determine the early history of the Eskimo. (*17*) Since it appears that these migratory people have spread from Asia across to Greenland in the past two thousand years, such Canadian work must be correlated with that done in other Arctic areas. Recent studies at the Bureau of Northwest Territories and Yukon Affairs have determined the present camp-sites and general distribution of the Eastern Arctic Eskimo population and this can be extended to include all Eskimo areas. (*36*) In order to protect the archaeological remains from tourists and curiosity seekers, the Northwest Territories Administration has instituted regulations which permit only trained archaeologists to do excavating work. Research can be done in several places, but the once-inhabited far northern islands and the central mainland coast seem most promising areas.

MEDICAL RESEARCH

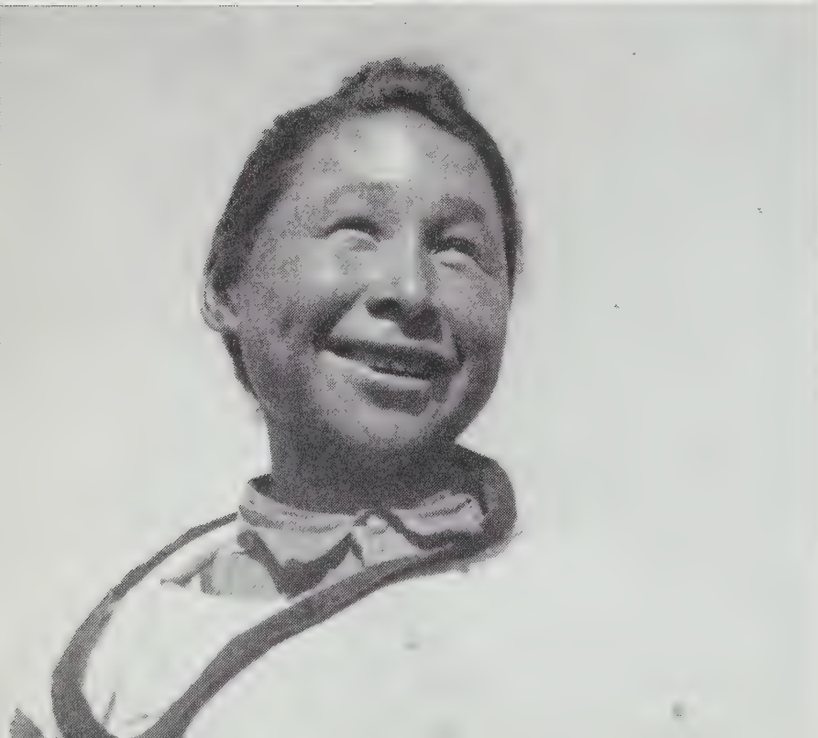
Since 1922, investigations into the health and welfare of the native population have been carried on by the Dominion Government. One of the most notable early surveys was made by Dr. L. D. Livingstone in the Cumberland Sound and southern Baffin Island area in 1926-27. (*12*) In addition to the researches done by the resident government doctors in the mission hospitals at Chesterfield and Pangnirtung, a government



Surveyor John Carroll and a family of caribou-hunting Eskimo at Hantzsch River, western Baffin Island. The natives are of very short stature.







doctor always accompanies the Eastern Arctic Patrol and reports on Eskimo health conditions at each post visited.

Research work on the metabolism of Eskimo and their susceptibility to disease was carried on by Dr. Peter Heinbecker attached to the Putnam Baffin Island Expedition in 1927. He continued this type of work while attached to the Eastern Arctic Patrol in 1930 and 1931. (*37*) Dr. I. M. Rabinowitch of Montreal General Hospital was equipped with a complete biochemical laboratory and other apparatus when he accompanied the patrol in 1935. He later published articles on his clinical observations and metabolic and other studies. (*38*)

Conclusion

The present war has seriously curtailed most scientific research in the Eastern Arctic, but work that bears a military purpose has gone on, and, when peace comes, plans will be ready to resume the search for knowledge. The lure of the North and the undefinable attraction of forlorn Arctic regions will again call scientists, research workers, and explorers into the Eastern Arctic to unfold more of its fascinating mysteries.

Although protecting the North by requiring scientists' permits from any one entering the region, the Northwest Territories Administration has always encouraged organized investigation and particularly hopes to expand the scope of these researches in the post-war period. With the establishment of permanent research stations, and aided by modern methods of transportation and communication, the task should be easier and progress will be greater. The exploratory period, which was extended over a period of three centuries by the forbidding limitations of the natural environment, has now virtually passed, and the present era of organized, detailed investigation will provide Canadians and others with much additional information about the vast northeastern regions of the Dominion.

Top to bottom: Eskimo portraits of man, woman and youth at Port Harrison

Photos by Pierre Dagenais

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Eskimo women in winter clothing at River Clyde

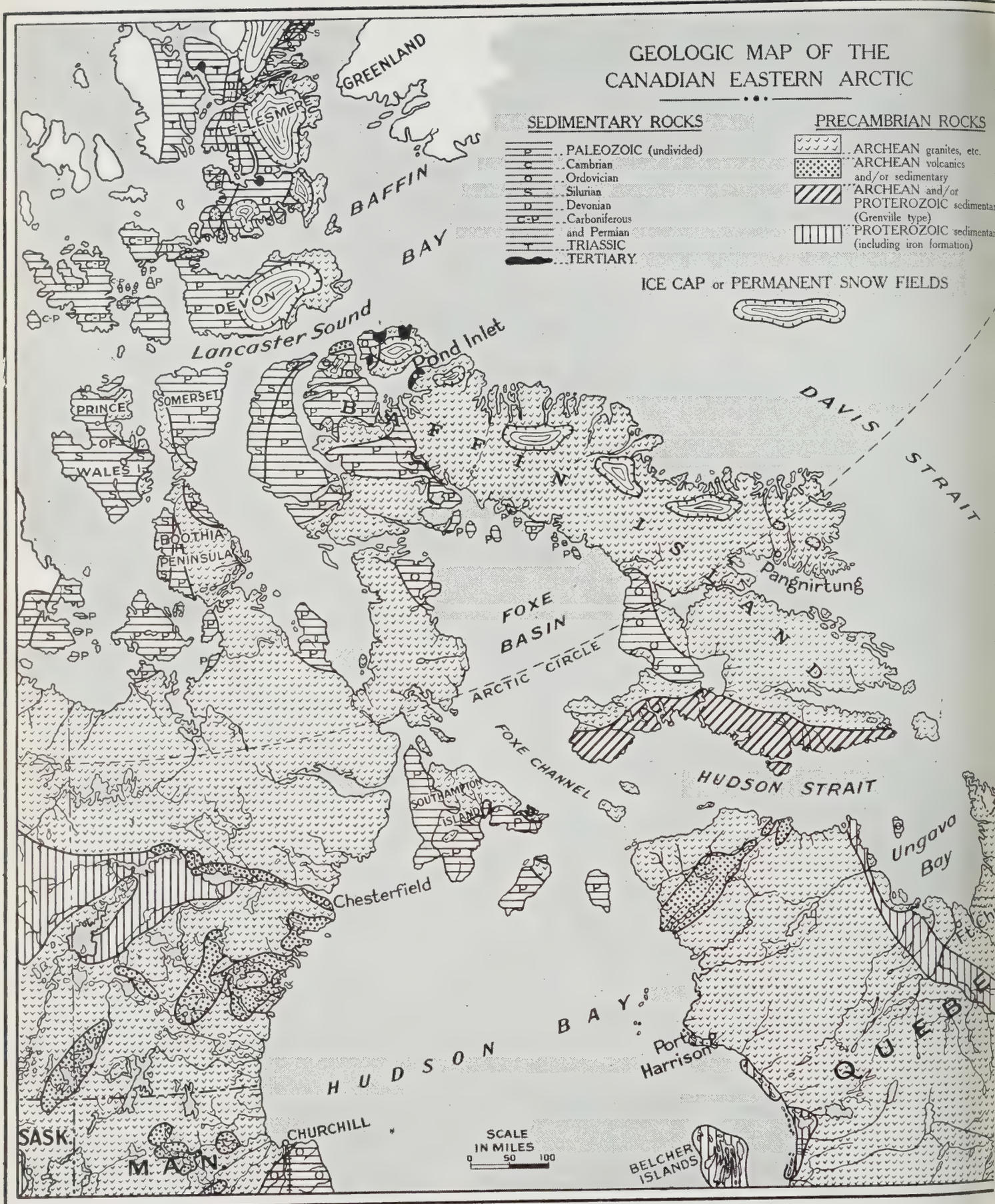
Photo by S. Hluckan



PRINTED IN CANADA

Mineral Resources and Mining Activity in the Canadian Eastern Arctic

(*Reprint from the CANADIAN GEOGRAPHICAL JOURNAL, August, 1944*)


GEOLOGIC MAP OF THE
CANADIAN EASTERN ARCTIC
SEDIMENTARY ROCKS
PALEOZOIC (undivided)
Cambrian
Ordovician
Silurian
Devonian
Carboniferous and Permian
TRIASSIC
TERTIARY
PRECAMBRIAN ROCKS
ARCHEAN granites, etc.
ARCHEAN volcanics and/or sedimentary
ARCHEAN and/or PROTEROZOIC sedimentary (Grenville type)
PROTEROZOIC sedimentary (including iron formation)
ICE CAP or PERMANENT SNOW FIELDS
GREENLAND
ELLESMERE
BAFFIN BAY
DEVON I.
Lancaster Sound
Pond Inlet
BAFFIN ISLAND
DAVIS STRAIT
SOMERSET I.
PRINCE OF WALES I.
BOOTHIA PENINSULA
Pangnirtung
FOXE BASIN
ARCTIC CIRCLE
FOXE CHANNEL
HUDSON STRAIT
SOUTHAMPTON ISLAND
Chesterfield
Ungava Bay
HUDSON BAY
Port Harrison
QUEBEC
SASK.
MAN.
CHURCHILL
SCALE IN MILES
0 50 100
BELCHER ISLANDS

Mineral Resources and Mining Activity in the Canadian Eastern Arctic

by J. LEWIS ROBINSON*

CANADA has two Northlands—the West and the East. The former has been geographically endowed with resources possible of development; the latter is a barren, bleak and little-developed region. The two regions are quite distinct and differ greatly in many respects. The problems which are met in opening-up and developing Canada's Western Northland are not the same as those which will be met in the Eastern Arctic. While it is possible to move about fairly freely in the Mackenzie Valley area during the summer and to a lesser extent during the winter, the Eastern Arctic is almost cut off from the rest of Canada during the winter, except for the god-send of radio. In the East, summer transportation facilities are different from those of the West and more limited by natural conditions.

The Eastern Arctic may be roughly defined as that part of Northeastern Canada north of the tree-line, which is serviced from the Atlantic and Hudson Bay. It comprises an area of about 700,000 square miles, including most of the numerous and large Arctic Islands, totalling about 19 per cent of Canada. In this area, about twice the size of the Province of British Columbia, or about equal to the area of Quebec and Manitoba combined, live about 150 white inhabitants and 6,000 Eskimo (79 per cent of the Canadian Eskimo population).

There are 30 tiny settlements within this region, approximately 100 to 200 miles from each other. Each of the settlements has a trading post which consists of four or five buildings. Many of them have no more than that, while others may have Department of Transport Radio and Meteorology Stations, Royal Canadian Mounted Police detachments, and church missions. The two hospitals at Chesterfield and Pangnirtung are normally attended by Government doctors. The largest settlements have from 25 to 30 buildings in all, including warehouses, outhouses and blubber sheds, and approximatel y15 or 20 people is the greatest white population at any one place.

The region may be reached only by water or air, the dependability of both methods being influenced by natural conditions. The nearest railroads terminate at Churchill on western Hudson Bay, and Moosonee on southern James Bay. There are no roads within the area and no need for roads, since nearly all of the tiny settlements are located on the coast. Supplies and mail are brought into each of the posts during the short summer season, and communication during the rest of the year is by radio, with which each settlement is equipped. Air transport is still in its beginning stages and has been hampered by serious fog and icing conditions. Water transportation has been the only dependable way of reaching the settlements and it has been hindered at times by uncertain ice conditions in a short navigation season. From late October to late June the harbours are frozen over, and the sea-ice extends for several miles out from the coast. Drifting ice floes which reach the Atlantic through Hudson and Davis Straits may impede navigation at any time.

These are some of the problems of the Eastern Arctic, and illustrate why a study of the geography of the region is necessary to understand why it is so different from the rest of Canada, and why development has come slowly to the area.

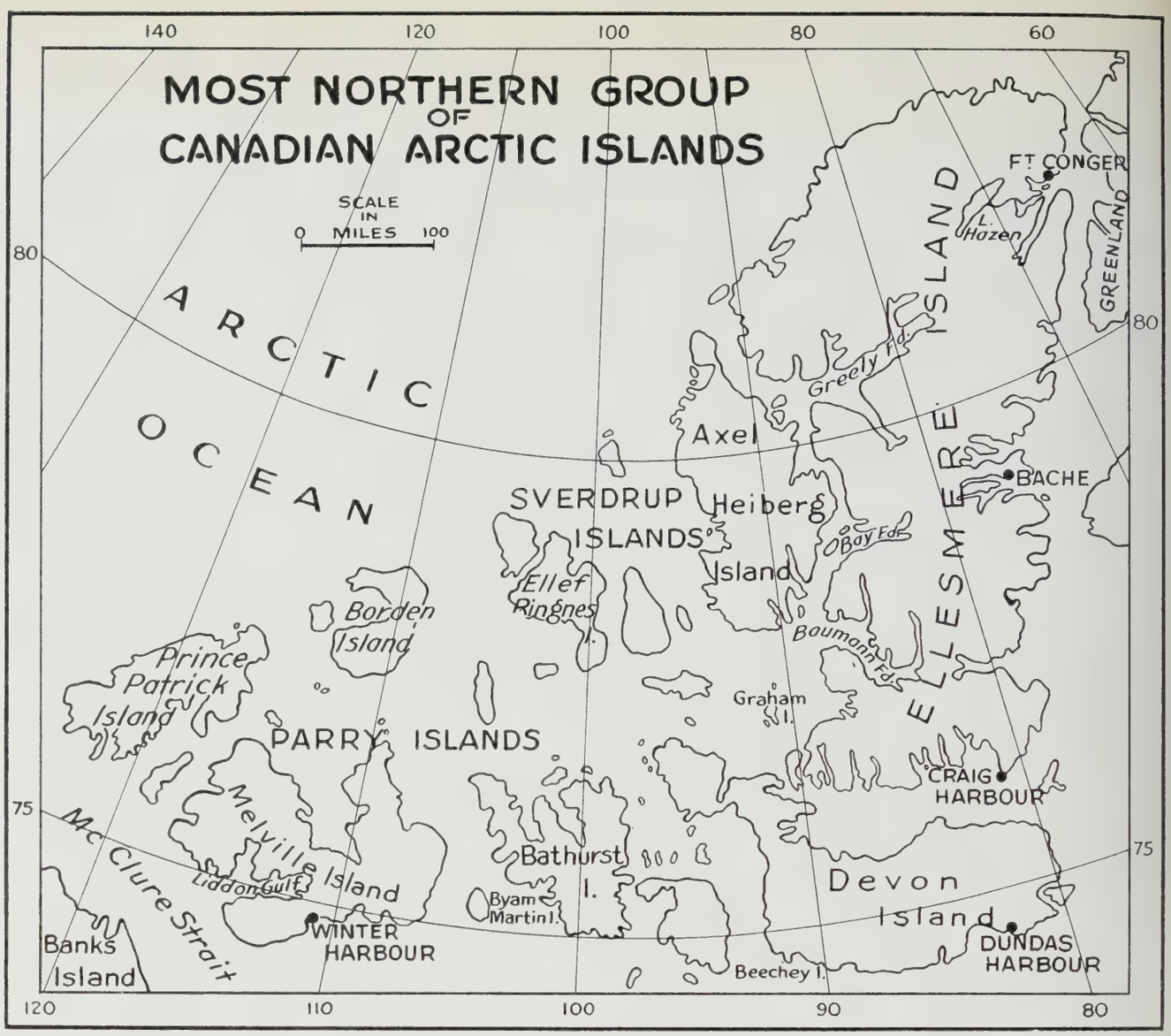
The resources of the Eastern Arctic are limited. They are limited both in known quantity and quality, and also in relative accessibility to the more populated parts of Canada. The last Ice Age left the Eastern Arctic as an area of little possible agricultural development by virtually denuding it of soil. The

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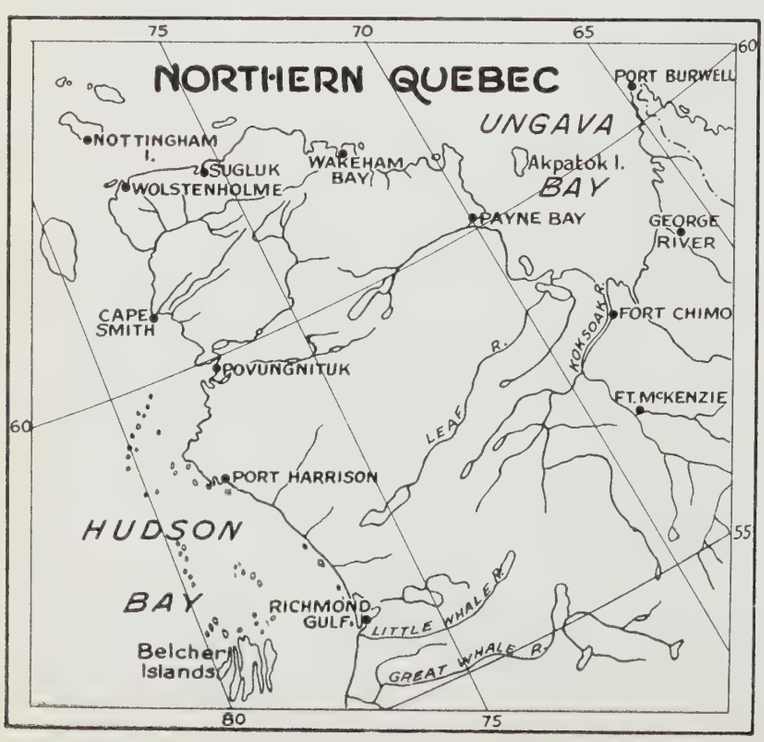
PANORAMIC PHOTOS BY A. L. WASHBURN



present Arctic climate, influenced by the cold Labrador current flowing southward between Greenland and Baffin Island, has maintained the region as a generally "barren" land with no forest growth.

To the natives of the area, who comprise most of Canada's Eskimo population, the chief resource is the game of the land and sea. They hunt the caribou herds which migrate over a large part of the area, and use them for food and clothing. The Eskimo traps white foxes during the open season and trades the furs to the trading companies for ammunition, food, and utensils. An abundant sea life in the form of seals, walrus, white whales and fish supply food, dog-feed and clothing to the native population. For the limited Eskimo population of this vast region the game resources have been fairly adequate in giving them a relative self-sufficiency.

But what are the resources of the region which will attract interest from the rest of Canada and encourage development? It has been true of many pioneer areas that mining has been the forerunner of future settlement, and, in the Mackenzie District of the Northwest Territories, it is one of the bases for economic development, when associated with other resources. In a region such as the Eastern Arctic, where other assets are either limited or lacking, mineral resources become important in estimating the value of the area; and a general knowledge of the geology of the

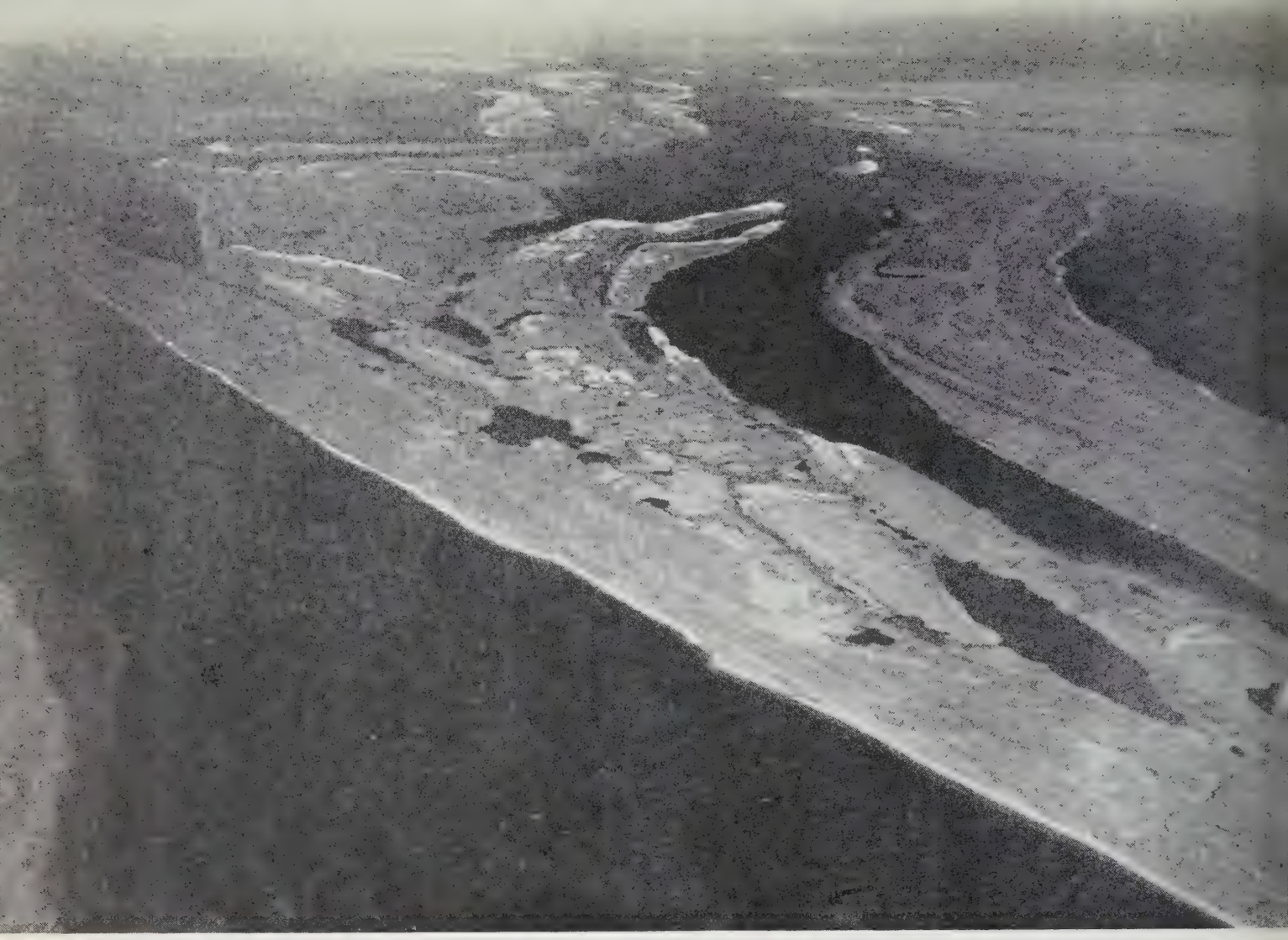




West coast of Hudson Bay. The low, swampy and lake-dotted character of the coast which extends westward from Hudson Bay makes overland travel by foot very difficult in the summer, while canoe travel is hampered by glacial drift which has cut off drainage. When this region is frozen over and snow-covered, sledge travel by dog-team is relatively easy.

R.C.A.F. photos





The Belcher Islands. These low, rocky islands in the eastern part of Hudson Bay were only rediscovered in 1916, and had not been visited for almost two centuries previous to that. They were mapped by aerial photography in 1932, and are a maze of linear bare rock ridges and long inlets, sounds and bays. The islands are potentially important as a source of iron ore, but have their present importance as the home of about 160 Eskimo who live chiefly off the sea life in the surrounding waters.

R.C.A.F. photos



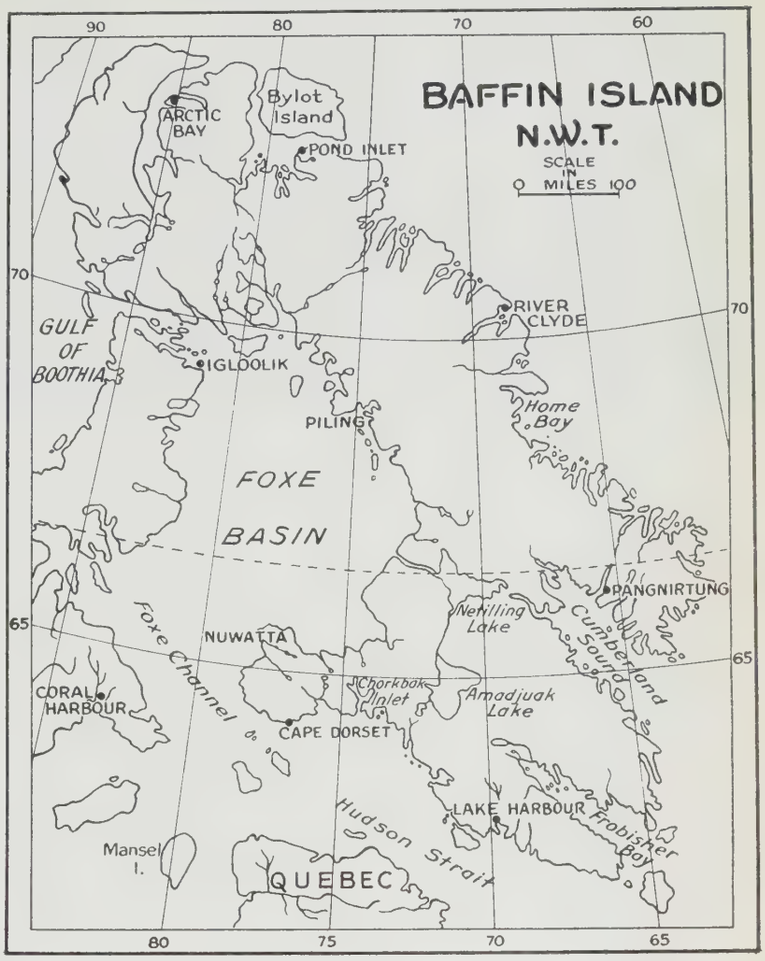
region is fundamental in understanding the mineral possibilities.

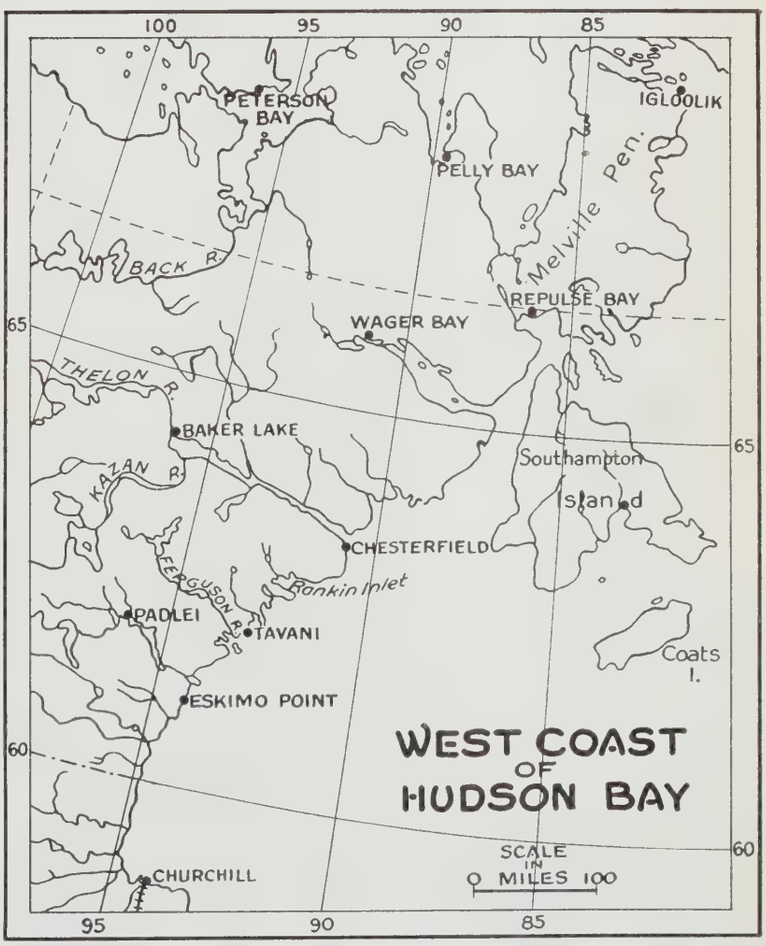
General Economic Geology

In any consideration of the economic mineral possibilities of the Eastern Arctic, basic factors of geologic structure and mineralization must share their importance with problems of accessibility, transportation and climate. Much of the area is underlain by Precambrian rocks of the Canadian Shield from which great wealth in rich minerals has been extracted in its southern and western sections. The ancient assemblages of sediments and volcanics, which occur amid the predominant granites and gneisses of the Eastern Arctic, resemble the rocks which are found in the southern part of the Shield. "Since these rocks in the Northwest Territories seem to be the counterpart of those to the south both as regards the kinds of rocks present and their relations with the invading igneous rocks, there is no known reason why they, too, should not be the sites of valuable mineral deposits." (1) Limited prospecting has shown this mineralization is present locally.

Although the fact that minerals are to be found is promising, it must be noted that to overcome the higher costs of transportation and development any finds must be proportionately richer than those in more accessible areas. Geologic knowledge has indicated that mineral wealth may be found, but economics and geography must determine whether these resources can or will be developed. Although information on the geology of the Eastern Arctic is based primarily on what has been observed along coastal strips, with interpretation for the interior areas, it is sufficient to take a broad view of the region in considering economic possibilities. Certain areas seem to be promising, while others can be ignored for several reasons.

The areas covered by ice caps or permanent snow-fields can be excluded from economic consideration. This includes several large sections in Ellesmere Island, most of Devon Island, much of the interior of Bylot Island, and scattered high or mountainous areas of Baffin Island. In Keewatin and Ungava Districts there are extensive areas, as yet not closely defined as to boundaries, which are covered by glacial drift. Prospecting is difficult or





(1) Stockwell, C. H. and Kidd, D. F., *Metalliferous Mineral Possibilities of the Mainland Part of the Northwest Territories*, Summary Report, 1931, Part C, Geological Survey, Canada, p. 71



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impossible in such areas because structure is hidden, and only drilling can reveal with certainty what lies below.

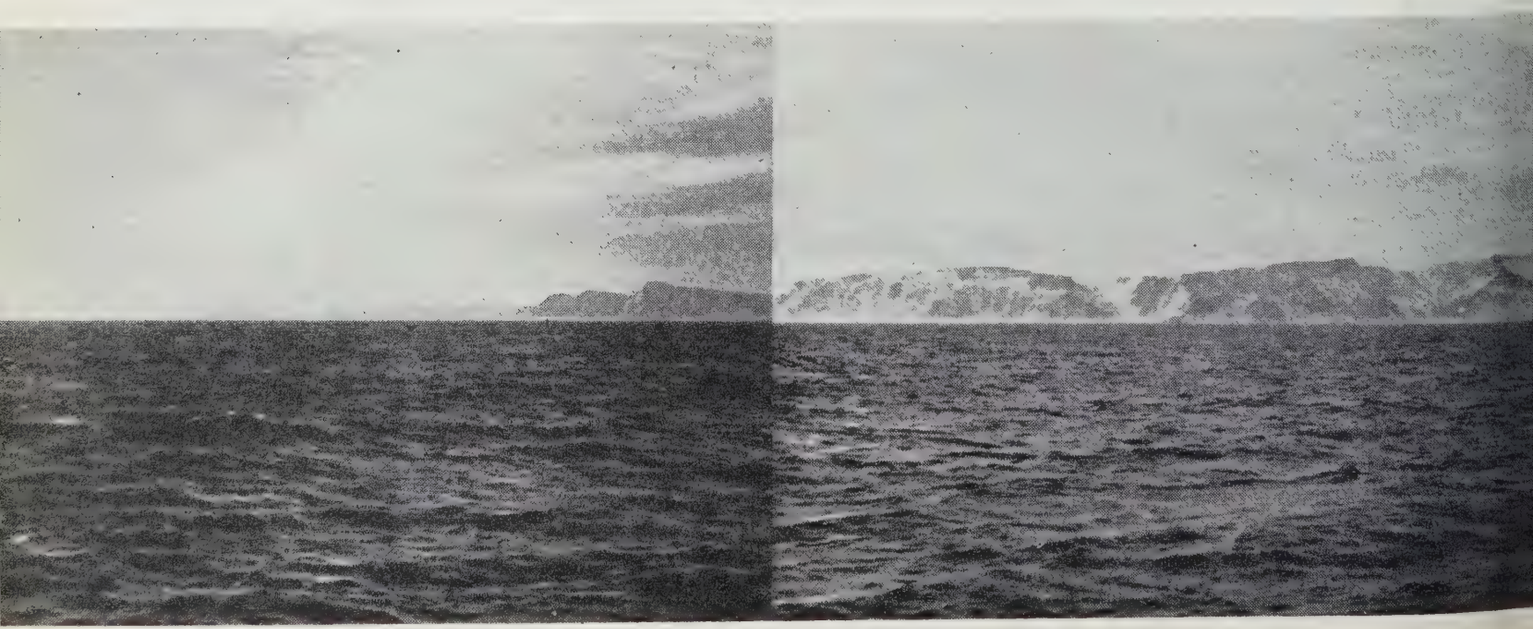
Sedimentary rocks of Palaeozoic age are found mainly in the central and western Arctic islands. Since the latest known period of widespread mineralization in Canada preceded the deposition of these sediments, rocks of this and later ages may be excluded as promising sources of metalliferous deposits. Such rocks, however, may still be considered as sources of coal, oil or gas. Most of the far northern islands, except the east coast of Ellesmere and Devon Islands, are included in this category. Similarly, large areas of sedimentary rock occur on Prince of Wales and Somerset Islands, Brodeur Peninsula and the central west coast of Baffin Island, the coasts of Boothia, Simpson and Melville Peninsulas, and the southwest half of Southampton Island.

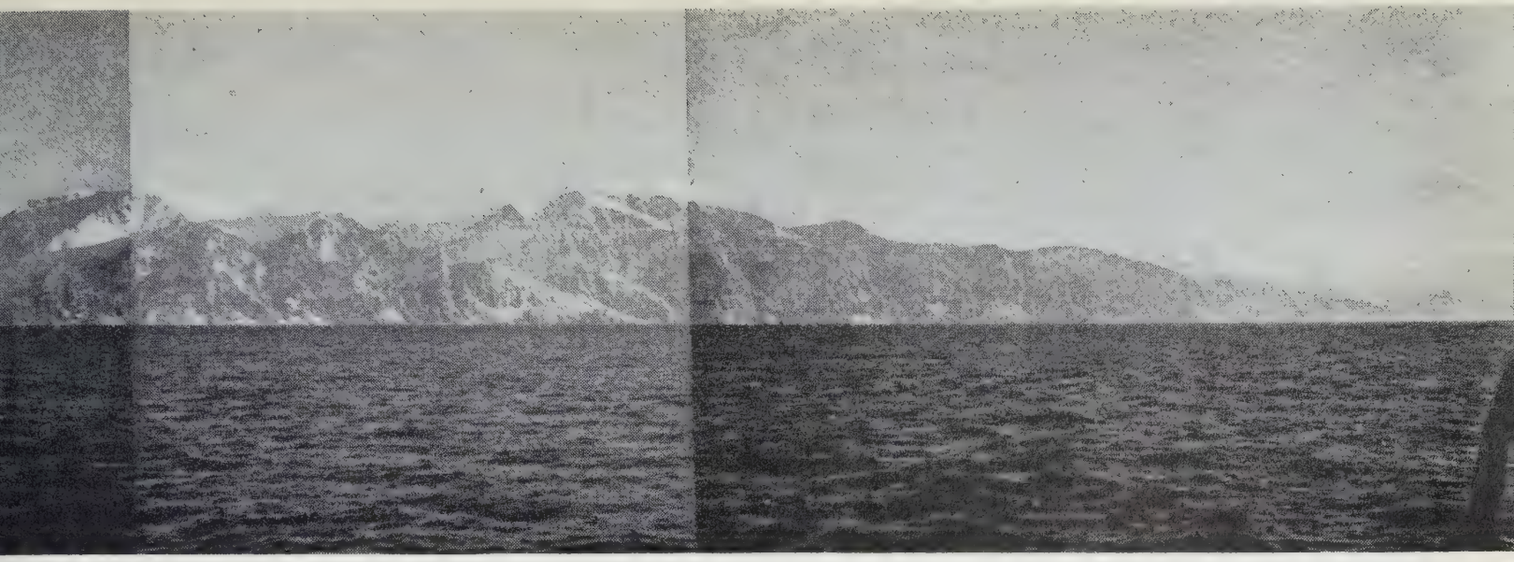
Inaccessibility by ship, because of ice conditions, prohibits much hope for the development of the Parry or Sverdrup Islands, unless large ice-breakers are used. In the same way, difficulties of sea-transport as a result of drifting ice in the very short navigation season makes mineral development unlikely along the east coasts of Ellesmere and Devon Islands.

Most of Keewatin and Ungava Districts and Baffin Island remain as areas of Precambrian granites, gneisses, schists, sediments and volcanic eruptives. These areas have been relatively well endowed both as to mineralization and accessibility. Here, also, lack of tree growth and soil leaves the rocks exposed to the prospector after many millions of years of weathering.

West Coast of Hudson Bay

Along the western side of Hudson Bay the coast is low-lying and generally flat. It is dotted with countless lakes which spill uncertainly one from another. The rivers and lakes which appear on the maps are chiefly the routes of early explorations, but from the air they may be difficult to pick out from the other numerous unmapped lakes and rivers which surround them. Coastal transportation is limited to small





Pond Inlet

schooners along much of this low coast because of the shallow water and shoals which extend into Hudson Bay. In winter, travel is fairly easy by dog-team across the frozen, snow-covered surface, but in summer the myriads of lakes, swamps and intervening spongy muskeg confine travel chiefly to the rapid-infested rivers.

One of the most promising areas for mineral development lies between Eskimo Point and Chesterfield on the west side of Hudson Bay and inland as far as the Kazan River. The region, so far as is known, is mainly underlain by two divisions of rocks, both of Precambrian age. One group consists of granite and granite-gneiss, the other of volcanic and sedimentary strata.(2) Although the gneisses have produced mineral wealth in the southern part of the Shield, the granites have been found to be generally barren, and therefore it is likely that those of the northern region will be similarly lacking in economic minerals. The volcanics and sedimentary strata, on the other hand, are known to contain mineral deposits.

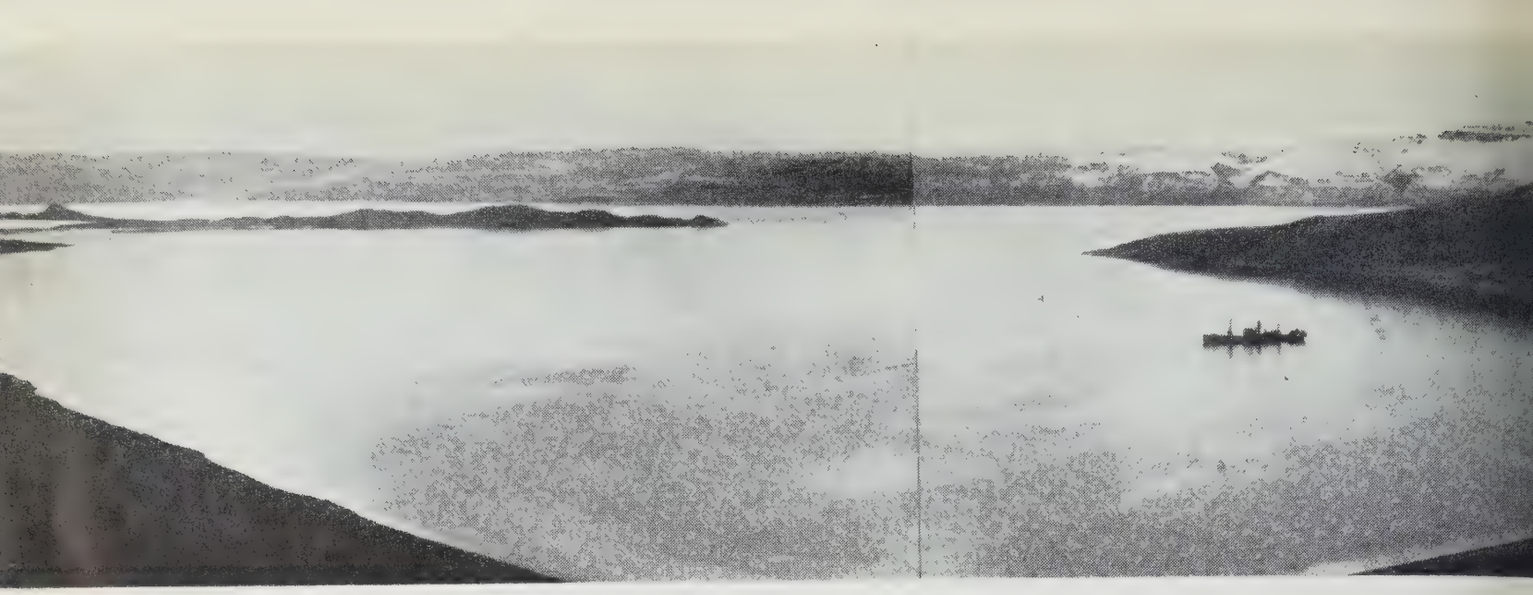
Although traces of gold and silver were first reported from this area in 1885 by Robert Bell of the Geological Survey of Canada, it can be said that intensive prospecting of the mineral resources did not start until 1928. At that time four major companies turned their attention to the Hudson Bay region and simultaneously explored the area with the use of canoes, supply ships and spectacular servicing by aeroplane. These companies were: Northern Aerial Minerals Exploration (N. A.M.E.), Dominion Explorers, Cyril Knight Prospecting Company, and Nipissing Mining Corporation.

During the spring of 1928 unsuccessful attempts were made to reserve large areas for certain companies. However, all started on an equal basis as soon as the ice broke up and the season opened. Late in July the N.A.M.E. ship *Patrick and Michael* and the Dominion Explorers' schooner

(2) Weeks, L. J., *Rankin Inlet Area, West Coast of Hudson Bay*, Summary Report, 1931, Part C, p. 40, Geological Survey, Canada

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Arctic B

Morso entered Hudson Bay, but arrived too late in the season to allow for little more than preparatory work for the next season's activities. The *Patrick and Michael* was wrecked at the entrance to Baker Lake, but most of the equipment was saved and N.A.M.E. established their base and wireless station at the old Royal Canadian Mounted Police barracks near this place. The *Morso* brought material for a base and wireless station at Tavani and also delivered supplies safely to another base at Baker Lake. Planes were carried to the Bay on the ship, and later others flew in to join the Dominion Explorers' expedition.

The Nipissing Mining Corporation sent canoe parties into the area west of Hudson Bay. One came via Great Slave Lake and the Thelon River and the other by rail to Churchill and thence along the coast. The Cyril Knight Company used canoes for exploration and aeroplanes to service their parties.

In the 1928 season, investigation was limited chiefly to the coast, with exploratory flights inland. Only two locations were staked: gold at Term Island by the Nipissing party, and pyrrhotite at Rankin Inlet by the Cyril Knight Company. Mineralization was noted at several scattered places, but occurrences were small.

During the winter N.A.M.E. maintained their base at Baker Lake, while the Dominion Explorers' party stayed at Tavani. The latter group made a difficult flight to Baker Lake, but abandoned further attempts at winter flying. They also tried to move freight by tractor north from Churchill over the sea-ice along the coast.

Early in the spring of 1929 men and planes gathered at Churchill and started an early season of reconnaissance. Spring mists hung over the land most of May, hindering ski-plane observations, and then in late June flying was suspended until the ice on the lakes broke up. Ground

Cape Smith, on Sn





orthwest Territories

parties could do little prospecting work until the end of June, when the surface was free of snow.

The Nipissing and Knight companies confined their summer activity chiefly to proving and developing their claims on Term Island and on the north shore of Rankin Inlet. The other two companies continued aerial exploration and servicing of their ground parties, who were scattered from Eskimo Point and Padlei on the south to Repulse Bay on the north, and as far inland as the Kazan and Thelon Rivers.

The Nipissing Mining Corporation located and prospected a mineralized shear zone near the contact between the volcanic rocks and granite on the northeast side of Term Island. Free gold, accompanied by pyrite and chalcopyrite, was found in quartz and silicified greenstone. A small open cut was hand-picked and about 1,100 pounds were shipped out. This proved to be the extent of the deposit.

Work of Dominion Explorers covered a broad stretch of low-lying coast south of Chesterfield in which rock exposures are meagre due to glacial drift, and where little could be done without more intensive study than was possible at the time. The more rugged country north of the inlet was found to be largely unpromising granites or gneiss.

Late in the summer the MacAlpine party in a Dominion Explorers' plane was forced down on the Arctic Coast, and were cared for by Eskimo until Dease Strait froze over, when they were guided to the Cambridge Bay trading post on Victoria Island. In the widespread searching operations carried on by plane for the missing party, much more of Keewatin and eastern Mackenzie became known by aerial reconnaissance.

During the 1929 season no new finds of importance were made in the Hudson Bay area, and in the following year the two aerial companies turned their attention to the Coppermine River area. Although

of Hudson Bay





Cape

the Hudson Bay activity was ambitious for that time, it was barren of economic returns. The costly adventure was useful chiefly in giving valuable experience, which helped in future operations in the Mackenzie District, and in pointing out some technical problems that had to be overcome in the planes of that time. Large sums of money were spent in two seasons of investigating the Hudson Bay area, but no economic deposits were discovered; the only claims staked were by the two companies who used more conservative methods.

The conclusion stated by Guy Blanchet, who was one of the leaders of the Dominion Explorers' field party, was that, after two years of intensive prospecting on a large scale, "Where the exposed rock was of a character that might lead to the expectation of mineral deposits, the lack of intrusive bodies and structural disturbances discouraged the hope of finding anything important".(3) However, much of the country rock was covered by glacial drift that hampered prospecting, so that these operations do not necessarily prove the country worthless for mining. Exploration has shown that the area is definitely mineralized, and it remains for future investigation to attempt to discover commercial deposits.

The Cyril Knight Prospecting Company was the only party to return to the west coast of Hudson Bay in 1930. Diamond drilling during that season showed that their claims at Rankin Inlet contained a mineral body which is a sulphide ore intruded between sedimentary and volcanic rocks, containing considerable pyrrhotite

(3) Blanchet, G. H., *Preliminary Report on the Aerial Mineral Exploration of Northern Canada*, Dept. of the Interior, 1930





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with a little chalcopyrite, pentlandite and pyrite. In one place the mineralization extends beneath the sand and gravel of the shore.

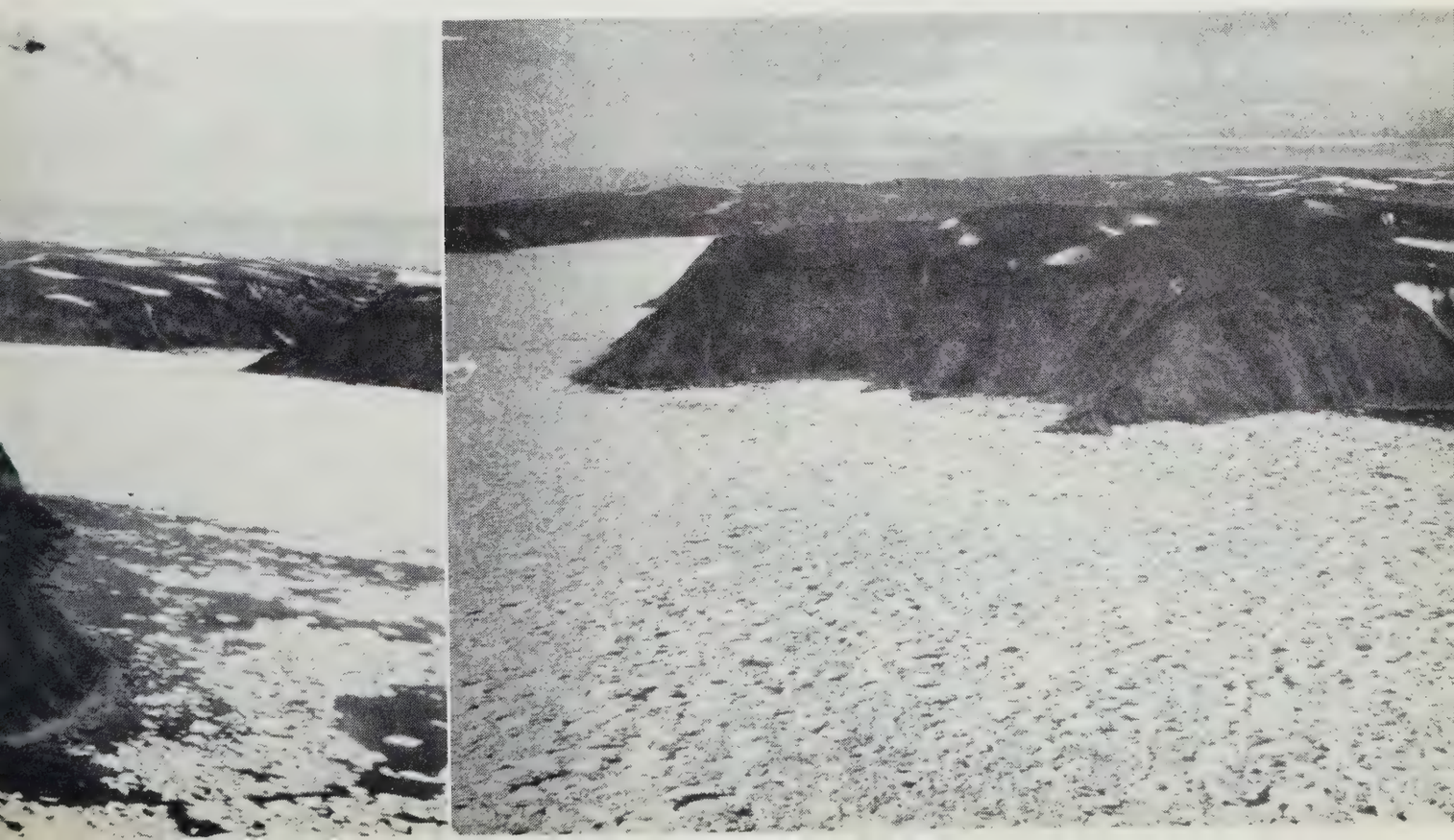
The Company estimated that a profit could be made by shipping out the 30,000 tons of indicated high grade ore to a smelter, but, unless more than 200,000 tons of medium grade ore could be uncovered, it would not pay to build a concentrator on the location. It was further estimated that one million tons would have to be found to justify the construction of smelting and refining facilities at the ore body. In 1931, however, the Cyril Knight Company claimed that owing to the remoteness of the area, the lack of transportation, and the depressed condition of the base metals market, further development of the mineral deposits at Rankin Inlet was inadvisable, and requested that the area be withdrawn from the representation provisions of the Quartz Mining Regulations.(4) In June, 1931, due to general adverse conditions, a moratorium was created in the whole Northwest Territories relating to representation work. This moratorium expired in October, 1933, and claim owners again had to work on their claims to maintain them in good standing.

In 1935, International Nickel representatives flew in to Rankin Inlet with Cyril Knight to investigate the property. In 1937, due to the fact that some of their claims were expiring unless additional work was carried on, the Knight Company

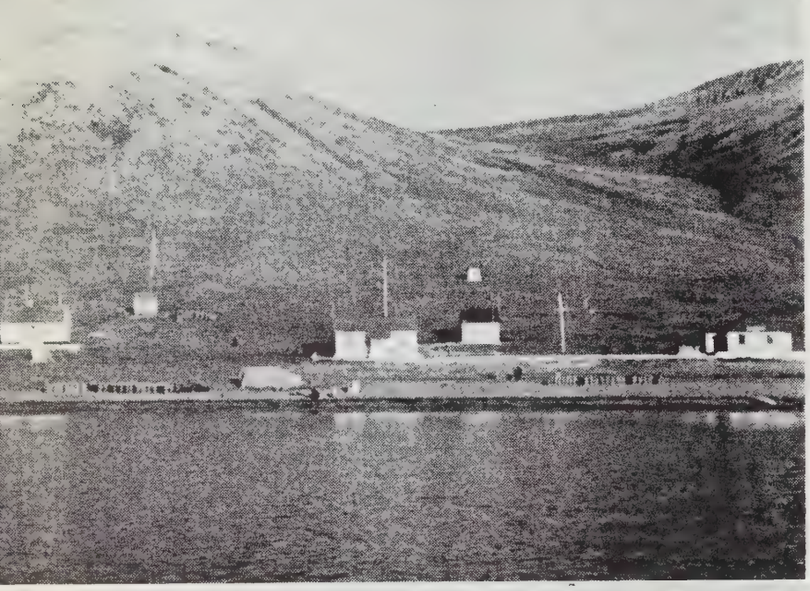
(4) Any licensee who has recorded a mineral claim is entitled to hold it for one year provided that he performs work on the claim to the value of at least one hundred dollars. Any excess may be credited to subsequent years.

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R.C.A.F. photos











decided to prove up the deposit thoroughly for its size and economic possibilities.

In mid-April, 26 tons of mining material, including drill equipment and a radio station, were carried by ski-equipped planes from Churchill to Rankin Inlet. They planned to ship in further mining equipment by boat when the navigation season opened, after obtaining drilling results. Their plans thus utilized the advantages of both air and water transportation. Drilling lasted from May to July, and when the results indicated that the mineral body was not of a substantial tonnage, the ship did not sail with the further equipment. The report of 2,413 feet of drilling operations showed that the ore body pinched out and was only 350 feet long and 100 feet deep. The Company's engineer in charge reported that "it is believed that sufficient drilling has been done to indicate that the body is limited in extent".

Other individuals and companies have investigated the mineral possibilities of Keewatin District within recent years. A private prospector from Churchill staked some claims near Padlei in 1938. In the summer of 1941 the Hudson Bay Mining and Smelting Company flew a group of prospectors north to Padlei and from there they spent the season investigating the area. Previous to that the Company had already quietly carried on two years of extensive mapping and reconnaissance geology. However, no claims were filed as a result of their work.

During the summer of 1942, several prospectors of the Hudson Bay Exploration and Development Company explored the area west of Hudson Bay, between latitudes 60-63° north, and as far west as longitude 99°. The Company staked four widespread claims within this region.

*East Coast of Hudson Bay**

Ungava Peninsula of Northern Quebec is a rolling plateau area which rises rather abruptly along the eastern Hudson Bay

Top to bottom:—

Hudson Bay post, Lake Harbour
R.C.A.F. photo

Arctic Bay, Baffin Island, September, 1943

Wolstenholme, Ungava, Quebec, August, 1943

River Clyde, Northwest Territories, October, 1943

*See map page 4.



Pond Inlet post, Baffin Island, October, 1943

and southern Hudson Strait coasts to altitudes of 1,000 to 2,000 feet, and slopes down toward Ungava Bay. North of the tree-line, which roughly extends from southern Ungava Bay to Richmond Gulf on Hudson Bay, the surface is one of broad, alluvial and gravel-filled valleys between low ridges of bare rock. This area is similar to the west coast of Hudson Bay in that it is also underlain by the old Precambrian rocks which comprise the foundations of about two-thirds of Canada.

At the same time as the area on the west coast of Hudson Bay was being investigated, similar prospecting activity was being carried on along the east coast of the Bay. In 1928 N.A.M.E. staked several claims in the area of Little Whale River, searching for an extension of the lead deposits which had been mined there by the Hudson's Bay Company as early as 1749. They also sent two men inland to investigate native reports of copper and lead deposits. No further action was taken by the Company.

In the years 1931-32 a greenstone belt that extends into Ungava District from Cape Smith was prospected by several companies, led by the Cyril Knight Prospecting Company. Mineralization had been first reported from here, in 1900, by A. P. Low of the Geological Survey. The prospectors found the belt to be 40 miles broad, and they explored it inland for 150 miles. Mineral showings were located on Smith Island and the nearby mainland. In 1933 prospectors and supplies were transported by plane from Moosonee, and a more intensive study was made of the discoveries.

The greenstone belt,(5) probably early Precambrian in age, consists of altered lavas, and some sediments, all cut by diorite dykes. The area is bordered to the north and south by granitic and gneissic rocks. The rocks of most of the belt are intensely folded, with a generally north-east strike. Some of the pillow lavas are sheared and faulted.

The mineral showings are sulphide deposits which consist of massive, fine-grained pyrrhotite cut by veinlets of coarser pyrrhotite, associated in places with small amounts of chalcopyrite. Assays indicated, however, that the gold content of the quartz veins is either nil or so low as to be of no commercial value, while only traces of copper and nickel were found in the sulphides. The Knight Company decided that the mineralization of the whole greenstone belt was probably all of the same uniformly low grade and no further work was done.

Exploratory work has thus shown that mineralization occurs throughout this area, but testing of one section has shown that the sulphide bodies are much too low grade to encourage development. It is quite possible that the same condition applies to the whole greenstone belt, but only further prospecting can determine this. "The belt has been barely explored, not to say prospected, and it compares favourably in size with any of the larger areas of similar rocks that, throughout the Canadian Shield, are generally considered to constitute favourable ground for prospecting."(6)

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(5) Gunning, H. C., *Sulphide Deposits at Cape Smith, East Coast of Hudson Bay*, Summary Report, 1933, Part D, Geological Survey, Canada

(6) Gunning, H. C., op. cit. p. 154D

An iron formation of Proterozoic age found in the Nastapoka Islands and Richmond Gulf area of the mainland on the east side of Hudson Bay has been known for a long time.(7) Iron formations hundreds of feet thick were described by C. K. Leith in 1910.(8) Since then many of the leading steel companies have sent men into the area to look over the deposits carefully, and all have agreed that none constitute iron ore under present conditions. Seven of the islands of the Nastapoka group have been patented to two companies (in 1903 and 1916) giving rights forever to the surface and all base minerals except coal. No development work has been done on the iron formation. The other islands of the group have not been surveyed and are available for disposition under the Quartz Mining Regulations. These late Proterozoic sediments, however, hold little hope for finds of precious metals.

The Belcher Islands, located about 60 miles off the east coast of Hudson Bay, are a maze of narrow islands cut by long arms, bays, inlets and sounds. Their broken hills and long, low, black ridges are the eroded tops of submerged ranges which appear again northward in the Sleeper and King George group of islands.

An iron formation similar to that which was known in the Nastapoka area was investigated by R. J. Flaherty in 1916. When E. S. Moore reported on the iron, in 1918, he stated that he saw no ore of commercial value but that there was a large reserve of iron formation.(9) He found 39 feet of iron oxides mixed with jaspilite in bands and therefore very difficult to extract.

A more comprehensive study was made by G. A. Young in 1921.(10) He reported that "no iron ore of commercial value, under existing conditions, was seen. Highly ferruginous zones were found, and, where exposed, there were always two or more zones in evidence. Thickness of zones varied from 10 to 50 feet, with a total thickness of 365 feet."

"Examination of the material itself indicated that the zones are composed almost wholly of silica and iron oxides. The silica is largely in the form of quartz, the iron oxides in the form of magnetite and hematite, but a small proportion of the silica and iron oxides is combined as an iron silicate. In four samples tested, silica varied from 32-46 per cent. By hand-picking these layers the metallic iron content could be raised to 50 per cent, or more, but the silica content would still be greater than 20 per cent, and this hand-picking process would be expensive."

Young pointed out that the formation is similar to that forming the rich Mesabi Range of Minnesota, and that it is possible that ore bodies may be hidden by the glacial drift mantling the islands.

In 1928 the N.A.M.E. Company did some surface work and drilling in the iron deposits of the Belcher Islands. They found that some of the exposures contained as much as 48 per cent iron and that the ore was low in phosphorus. The Company, however, withdrew from the area due to difficulty of transportation to markets.

Most of the iron formation of the Belcher Islands has been leased to Belcher Islands Iron Mines Limited. In 1940, the Company claimed that "a suitable process for the development of the iron ore on the locations has been secured, and in spite of low grade ore and the remoteness of the Belcher Islands from markets, the Company is satisfied that, with further expenditure, an iron mining industry may be established". However, the Company has been unable to obtain priorities for steel equipment or the necessary labour to do very much work on the property since then.

In 1940, the Ore Dressing and Metallurgical Laboratories of the Department of Mines and Resources tested a sample of hematite from the Belcher Islands. They found that it contained 43 per cent iron and 29 per cent silica. The percentage of iron is relatively high, and is very finely crystalline. Ten per cent silica, however, is usually the limit for commercial development. The laboratories found that it was very difficult to separate the ore from the gangue by the common methods of concentration, and reported that "this iron formation does not seem suitable for commercial recovery of iron".

Thus, the iron of the Belcher Islands can be classed as an iron formation, but,

(7) Low, A. P., *Geology and Physical Characters of Nastapoka Islands*, Geological Survey of Canada, Vol. 13, Part D, 1900
(8) Leith, C. K., *Algonkin Basin in Hudson Bay, Economic Geology*, Vol. 5, 1910
(9) Moore, E. S., *The Iron Formation of Belcher Islands, Hudson Bay, Journal of Geology*, Vol. 26, 1918, pp. 412-438
(10) Young, G. A., *Iron-bearing Rocks of Belcher Islands, Hudson Bay*, Geological Survey, Canada, Summary Report, 1921 Part E, pp. 1-61



Richmond Gulf. Iron formations are exposed here in the tilted Proterozoic strata between Richmond Gulf and the east coast of Hudson Bay. This is near the southern limit of the Eastern Arctic, and has small trees growing in the sheltered valleys.

R.C.A.F. photos





Akpatok Island, Ungava Bay, provides striking example of sedimentary rocks

R.C.A.F. photos

Falls, Fort McKenzie, Quebec





Two striking air views of Baffin Island. Note the triple glacier in the upper photograph.

R.C.A.F. photos



so far as known, not as a deposit of iron ore under present conditions.(11) However, the islands have not been fully prospected, and higher grade deposits may yet be found. Though iron is present in large amounts, technological problems prevent it from being economically important at present. When this factor is combined with general inaccessibility and present lack of transport to the Belchers, it becomes evident that ores in more accessible places will be used before the reserve wealth of the islands becomes necessary.

In the interior of Ungava District on the Quebec-Labrador boundary, in the vicinity of Hamilton Falls, a large deposit of iron ore has recently been explored. Field work has demonstrated that ore is definitely present in large quantities. These deposits have been traced discontinuously as far north as Fort McKenzie. Rocks of a similar age continue north along the Koksoak River past Fort Chimo, where traces of iron formation were noted by A. P. Low in 1895.(12) Whether deposits with the grade of the Labrador ore occur this far north into the Eastern Arctic is not yet known.

*Baffin Island**

Baffin Island is the largest of the Canadian Arctic islands. Its area of slightly over 200,000 square miles is about equal to the area of the Province of Manitoba. The high mountain range which extends along its whole northeast coast from Pond Inlet to Cumberland Sound is the highest range of Eastern North America, with altitudes of 10,000 feet having been recently noted by aeroplanes crossing the area. Picturesque scenery reminiscent of Switzerland, is found in the long glaciers, deep fiords, and serrated ridges of this east and northeast coast, which rises majestically directly from the water. The south coast is lower and less spectacular. It rises steeply from the water in a drab, bare-rock surface to altitudes of about 1,000 feet and extends inland as a general rolling plateau of about 2,000 feet elevation. On the northern side the upland slopes down toward the broad tundra lowland west of Amadjuak and Nettilling Lakes.

The south and east coasts of Baffin Island hold possibilities of mineral wealth. Discoveries of mica, graphite and garnet have been noted at several places. However, most of the known minerals of the area are non-metalliferous, and occur either in small or low grade deposits. Their lack of value has prevented them from playing a part in the world market. The whole indented south and east coast of Baffin Island is accessible from the Atlantic for several months of the year, and although present known deposits have been of no value, the fact that mineralization has occurred should point the way to future investigation.

Attempts to utilize the mineral resources of southern Baffin Island have been unsuccessful. In 1876 an American took a large load of mica from the Cumberland Gulf area, reported to be worth $120,000; and in the early part of this century the Hudson's Bay Company mined the graphite of Blacklead Island. The Hudson's Bay Company also shipped a small tonnage of graphite from Lake Harbour in 1917-18 Following World War 1, the Hudson's Bay Company shipped both mica and garnet from Lake Harbour to England, but the project was soon dropped.

The Admiralty Inlet area, centring around the post of Arctic Bay in northern Baffin Island, is considered to be a promising prospecting area. Here faulted and folded Precambrian and lower Palaeozoic sediments have been cut by several dykes of gabbro and basalt. Mineralization is known to have occurred along the contacts. Gold, silver, platinum, copper, iron, nickel and antimony were found in small quantities by Captain Bernier's exploratory parties in 1910-11. Against the favourable facts of good structure and known mineralization are the problems of long distance from markets, a short and uncertain navigation season, and incomplete knowledge of the area.

An attempt was made to prospect the Arctic Bay area in 1937. J. F. Tibbett, geologist, accompanied by F. McInnes, a retired Royal Canadian Mounted Police officer, travelled by dog-team in the spring from Churchill to Arctic Bay via Chesterfield and Repulse Bay. They were delayed on the way and reached Arctic Bay only a short time before the *Nascopie* arrived on the Eastern Arctic Patrol to take them out again. The men found that snow cover hindered the work, and their time was too short for adequate reconnaissance They staked two claims each, but did not renew

(11) Tanton, T. L., Iron Geologist at the Mines and Geology Branch, Dept. of Mines and Resources, Ottawa
(12) Low, A. P., *Report on Explorations in the Labrador Peninsula*, Geological Survey of Canada, 1895

*See map page 7

them. On his return Tibbett was quoted as saying, "There is plenty of mineralization and unusual rock formation, and conditions are favourable for prospecting". (13)

Numerous fair-sized quartz crystals from the vicinity of Isabella and Home Bays in east Baffin Island were found by Eskimos who gave them to D. A. Nichols of the Mines and Geology Branch. Because of their scarcity and importance, future investigation may show these crystals to be of value, if they prove large enough for cutting.

In a land devoid of wood and developed water power, the numerous coal deposits of the Arctic islands may be of value in the future. The Tertiary lignite of Salmon River, near Pond Inlet, northern Baffin Island, has been known and utilized for several decades. The first recorded use was 155 tons which Captain Bernier mined in 1910 for use by the C.G.S. *Arctic* in her northern patrols. Captain Henry Toke Munn also used the coal at his trading-post at Pond Inlet in 1920. In 1924 the Hudson's Bay Company began to mine coal from a seam about three miles upstream on the east bank of the Salmon River. The workings of Captains Bernier and Munn were about a mile downstream from this, but had caved in.

In 1924, L. J. Weeks, of the Geological Survey, investigated the coal deposits and reported that there are two main seams, 3½ feet thick, about 18 feet apart, with the intervening rock usually containing several minor seams of one to two inches.(14) The beds are horizontal, or nearly so. When mined, this coal breaks into irregular lumps without signs of cleavage, and tends to crumble once it is left in the open. The associated sandstone beds weather so easily that the coal is exposed only where the river is actively undermining its banks. Coal exposures have also been found inland along the sides and tops of knolls, suggesting continuation of the beds. The coal is again exposed at the coast, on Eclipse Sound, about one mile west of the mouth of the Salmon River.

An analysis showed a low percentage of volatile matter and a fairly high fixed carbon content for a lignite coal. Although chemically the coal could be rated as of good quality, its physical property of easy crumbling makes transportation difficult. Attempts were made several years ago to ship the coal to River Clyde and Pangnirtung, but it crumbled so greatly that it was of little value upon arrival. Since the coal has a high heat value, briquetting is a possible method of shipment.

The coal has been used continuously by the Hudson's Bay Company post at Pond Inlet since 1924, and recently the Anglican and Roman Catholic missions also obtained permits to mine it. An Eskimo who is acquainted with the mining method can remove about 800 pounds of coal a day for the Hudson's Bay Company, using a little blasting powder and a long-handled steel drill. A total of about 50 tons is mined annually by the three parties of the settlement and transported to the post by dog-team.

The coal is usually mined in April, since it is neither hard-frozen nor soft, and can be chiselled out in larger lumps than at any other time of year.(15) It is impossible to mine during May and the summer months due to a steady stream of water running over the seams down the bank of the river, making the coal soft and crumbly. The coal is bagged and stored in a dry building, where wastage caused by crumbling and slacking during the summer is approximately 20 per cent. If it is left in bulk and exposed to the weather wastage is about 60 per cent. The coal burns well and gives out good heat as long as it is sifted and all dust removed.

*Other Canadian Arctic Islands**

In the Carboniferous rocks of the Parry Islands a high grade lignite or subbituminous coal is known to crop out in many places, and was utilized by early exploratory expeditions. Although not adequately examined, the fact that the coal is of the same general age as some of the world's great coal fields is suggestive. The value of this fuel to any future outpost or meteorological station, to which transportation will be exceedingly difficult, is obvious. Other coal deposits of the Arctic islands are generally of low grade, but being in an area where freight is expensive and fuel a necessity, they may become important.

Most of the western and northern Arctic islands may be geologically favourable for petroleum.(16) Meagre as our

(13) *Toronto Daily Star*, September 29, 1937
(14) Weeks, L. J., *The Geology of Parts of the Eastern Arctic*, Geological Survey, Summary Report, 1925, Part C
(15) Swaffield, A. T., H.B.C. Post Manager at Pond Inlet, 1940-43. Personal information
(16) Pratt, W. E., *Oil Fields in the Arctic*, *Harper's Magazine*, Vol. 188, Jan. 1944, pp. 107-112

*See map page 4

information is, we know that they are composed of sedimentary rocks, containing organic remains, ranging in age from Ordovician to Triassic. Recent investigations in southern Ellesmere Island show that the Silurian and Devonian rocks alone attain a thickness of 8,000 feet. Seepages of petroleum (or bituminous seepages) have been reported on northern Melville Island, and further exploration may reveal others. It is possible that the Arctic islands may produce oil similar to that now known in the Mackenzie River Valley and along the north coast of Alaska.

Summary

Any prospecting or mining activity which is carried on in the Eastern Arctic faces serious problems. General exploration costs are much higher than in some other areas of Canada because of relative inaccessibility and lack of all-year dependable transportation. Fuel and power have to be imported, thus increasing costs. Most of the area has not been mapped geologically, and information on structure is poor in many places. Much of the areas of low-relief topography, where movement is not too difficult, is covered by glacial drift, burying rock exposures. Moreover, the ground is permanently frozen a few feet below the surface, making trenching very difficult.

The Eastern Arctic is not an easy country to develop. It is different from any other part of Canada and has distinctive problems of topography, climate, ice conditions and transportation. Plans for exploiting the resources of the region will have to consider these matters before definite action can be taken. If one thinks of development in terms of exploiting the natural resources of any one area to the advantage of Canada as a whole, the mineral possibilities are the chief attraction of the Eastern Arctic.

Although incomplete knowledge of the geology of the area indicates the possibility of mineral resources, wealth will be hard to win. Mineralization is known in several widely-scattered places, but so far mining activity has been unsuccessful in locating mineral deposits of present economic value. The area is vast, however, and prospectors have covered only small sections of it. The old Precambrian complex which has supplied wealth to the more accessible areas of Canada may yet bring changes to the Eastern Arctic. The aerial photographs which are now being taken of the region will greatly assist future prospecting and map-making. Whether present mineral indications are the limits of development or point the way to future wealth is left for geologic investigation to determine.

The following is a list of all known mineral occurrences in the Eastern Arctic. It is a compilation of *occurrences* only, with no statement as to size or grade. In many places they are simply traces or small discoveries, often reported by untrained men. The purpose of the list, however, is to summarize what is known, show where mineralization has occurred, and point out areas where future investigation might be profitable.

Keewatin District

Rankin Inlet	Nickel, copper, platinum in pyrrhotite
Term Island	Gold, molybdenite
Corbet Inlet	Pyrites, copper, arsenic
Mistake Bay	Copper
Ferguson River	Gold
Rabbit Island	Arsenic
Baker Lake	Pitchblende, fluorite
Wager Bay	Gold
Belcher Islands	Iron

Ungava District

Port Burwell	Graphite
Koksoak River	Iron
Wakeham Bay	Garnet
Cape Smith	Pyrrhotite, copper, pyrite
Port Harrison	Silver, lead, soapstone
Richmond Gulf	Iron
Nastapoka Islands	Iron
Little Whale River	Silver, lead, copper

Baffin Island

Cape Dorset	Mica, copper
Nuwata	Asbestos
Chorkbak Inlet	Garnet, magnetite, pyrites
Lake Harbour	Mica, graphite, garnet, lazurite
Cyrus Field Bay	Copper, iron, phosphorous, pyrites
Cumberland Gulf	Mica
Blacklead Island	Graphite
River Clyde	Mica, iron pyrite
Isabella and Home Bays	Quartz crystals
Salmon River (Pond Inlet)	Coal
Milne Inlet (Phillipp's Creek)	Mica

Baffin Island	
Moffett Inlet	Mica
Yeoman's Island	Mica
Arctic Bay	Gold, silver, copper, platinum, nickel, antimony, iron, gypsum
Piling	Lignite
Bylot Island	
Cape Hay	Lignite
Canada Point	Lignite
Cameron Point	Hematite
S. W. Bylot Island	Magnetite
Somerset Island	
Fort Ross	Gold-bearing pyrite
Northern Melville Island	
	Petroleum (bituminous Seepages

Coal in Other Arctic Islands

Axel Heiberg Island	Mokka Fiord
Banks Island	Rodd Head, Cape Crozier, Cape Hamilton
Bathurst Island	Scoresby Bay, De la Beche Bay, Sargent Point, Schomberg Point
Ellesmere Island	Fosheim Peninsula, Baumann Fiord, Stenkul Fiord, Bay Fiord, Graham Island, Cape Murchison, Lake Hazen, Fort Conger, Watercourse Bay, Franklin Sound
Melville Island	Liddon Gulf, Winter Harbour, Cape Dundas, Bridgeport Inlet, Skene Bay
Byam Martin Island	
Edmund Walker Island	
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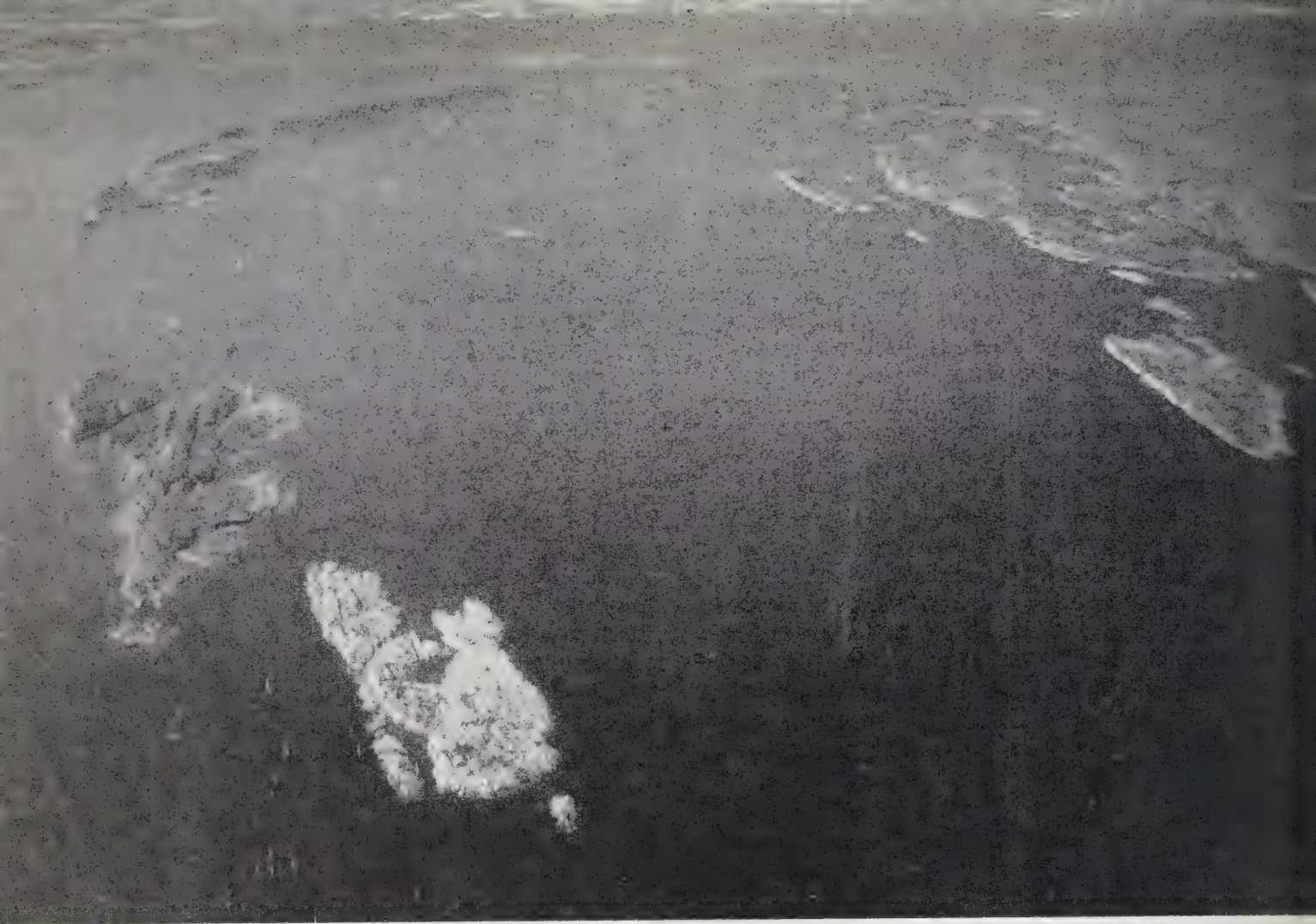
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Rankin Inlet. Deposits of pyrrhotite, containing nickel, copper and platinum, have been found on the north shore of Rankin Inlet. Glaciated, bare rock surface is exposed in the low hills along the north shore and on the islands in the central part of the inlet.

Ferguson River. This aerial view taken along the course of Ferguson River, a few miles inland from the west coast of Hudson Bay, readily shows the problems a flyer would have in picking out a mapped river from the surrounding numerous unmapped rivers and lakes. R.C.A.F. photos



Economic Wildlife of Canada's Eastern Arctic

——Caribou——

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Economic Wildlife of Canada's Eastern Arctic—Caribou

by J. G. WRIGHT

THE Eastern Arctic might be defined as those sections of Canada's Arctic regions most readily serviced from the Atlantic approach. It comprises the area between the Labrador boundary on the east to the west boundary of the District of Keewatin (Long. 102°) on the west and the islands lying generally north of this.

An Arctic region is defined as one where the mean temperature for the warmest summer month is less than 50° F. This temperature boundary coincides in a fairly general way with the northern limit of forest growth, or the "tree-line", as it is usually called. North of this line open field agriculture is not possible. At a few points small quantities of vegetables are raised under glass, but, for all practical purposes, the residents of the Arctic regions must depend upon imported foodstuffs or upon the animal foods found in the country. To the natives, animals provide not only the food necessary to sustain life, but in many cases the clothing

most suitable to withstand the rigours of the northern winters. In most cases, too, through the fur trade, animals provide the only source of income available to the native with which to purchase outside food-stuffs, ammunition, and equipment upon which he now depends for his continued existence. The fur trade is the only industry of present consequence and it can exist only where there are sufficient fur-bearing animals, and healthy natives to harvest the crop. The welfare of all human activity in the North is, therefore, specially dependent upon the welfare and abundance of the wildlife in the region. The conservation of wildlife consequently assumes a very important place in the administration of our Arctic regions, and all attempts to exploit these resources must be carefully scrutinized.

The Northwest Game Act and Regulations made thereunder provide for the conservation of game for the benefit of the native population, and regulate the establishment and location of trading posts. Hunting and trapping licences are issued only to residents, but native-born Indians, Eskimo, and half-breeds do not require licences. Trading permits are issued only when it is considered in the interest of the native or other residents to do so. Game preserves have been created in which only native-born Indians, Eskimo and half-breeds may hunt and trap. The Arctic Islands Preserve includes a large part of the Eastern Arctic region as shown on the accompanying map. The Game Regulations fix close seasons; provide for the issuance of licences to carry on fur-farming and the taking of game animals for propagation and scientific or other purposes, and otherwise regulate the game resources of the region in the interest of ensuring a continuing supply for the natives.

The following discussion does not purport to be a technical treatise on the animal life of the region, but is rather an attempt to trace the influence of certain fauna and their exploitation upon the economic life of the natives. Many Arctic animals fluctuate greatly in numbers from year to year and some of these fluctuations follow regular cycles. Some are subject to migratory habits so that in a given locality they may be plentiful at one season and almost entirely absent at others. All these and other factors of animal life tending to influence human activity are set forth briefly. Any one desiring to pursue more detailed studies on any phase may consult the bibliography on page 13.

Barren Ground Caribou

The barren ground caribou is one of the most important animals in the North. No satisfactory substitute for its skin has been found for the manufacture of winter clothing because of its strength, lightness and the insulating value of the hair, which consists of thin-walled hollow tubes. Where caribou skins are not available the Eskimo are poorly clothed with possible detrimental effects to their health.

The taking of caribou for clothing skins is complicated by the fact that the skins are suitable for this purpose only during a few weeks in late summer, after the old hair has disappeared and before the new hair has become too heavy. The mature males are free from old hair by the end of July and the females about the middle of August. There follows a period of about two or three weeks in each case when the skins are suitable for clothing.(10)

Caribou meat is considered by Eskimo and white men alike to be the best food produced on land, and the animal is hunted industriously by the natives whenever it is within reach. In areas of comparative scarcity or in regions such as islands and peninsulas, where the animals cannot readily escape, or be replaced by new migrations, this persistent hunting, especially with modern fire-arms, has so reduced the numbers that sufficient skins for clothing are no longer available.



Two male caribou fighting



Grassy lowland on northwest end of Coats Island

Caribou are, to a considerable extent, migratory, and many opinions have been expressed as to the purposes and routes of their migrations. In recent years much new information on caribou herds and their habits has been obtained from flying operations over the barren lands and by means of questionnaires supplied by the Northwest Territories Administration to competent observers throughout the North. It now appears that the migrations are usually slow seasonal movements in search of suitable grazing grounds, and that the animals may be diverted from customary regions by depletion of the food supply from overgrazing, by ground fires which destroy the lichens, grasses, and shrubs on which they feed, and by excessive hunting with fire-arms.

Region West of Hudson Bay

While caribou are widely distributed throughout the Arctic mainland and the islands of the Arctic Archipelago, they occur in much the greatest numbers over the barren lands west of Hudson Bay. Clarke(3) estimates the caribou population of this region west to Great Slave and Great Bear Lakes at around 3,000,000 head or less, on the basis of about 60 acres of grazing land per animal. He also estimates the annual gross increase at about 750,000 head. The present report does not, of course, extend beyond the west boundary of the District of Keewatin, and it is impossible to state the caribou population of this region since the deer in their migrations are not governed by imaginary geographical lines. Clarke, however, recognizes five groups of caribou which spend all or part of their time in this region:

a) Those summering on the Dubawnt and Kazan Rivers and wintering in northern Saskatchewan and Manitoba.

b) Those summering on the lower Kazan River and eastward, and wintering in southern Keewatin.

c) Those summering in southern Keewatin and wintering in northern Manitoba.

d) Those summering in the Wager Bay —Back River area and wintering on lakes on the Back River, Aberdeen and adjacent lakes and north of Baker Lake.

e) Those summering in Boothia and Melville Peninsulas and wintering farther south.

The Eskimo of the region southwest of Chesterfield Inlet are essentially inland people and subsist chiefly on caribou.(1) Of these there are several groups around and northwest of Padlei who have little sea culture or traditions, and who subsist entirely on inland country produce, of which caribou meat is the chief component. From native game returns supplied by the R.C.M.P. at Baker Lake it would appear that the caribou-eating Eskimo use about 9 caribou per person annually for themselves and their dog teams. This figure seems rather low, as it means only about 1,200 pounds of meat a year per

person for human use and for dog food, and each dog alone would probably require nearly that much. It is said that these inland natives use very little fish although the latter are plentiful in many of the lakes. A report on the Bureau of Northwest Territories file, from the R.C.M.P. at Coppermine, and dated May 15th 1939, in regard to native caribou hunting in the Bathurst Inlet district states that "a family of natives requires 25 clothing skins per year . . . It would be fair to estimate the requirements of an Eskimo family and its dogs (living largely on caribou meat) at 150 head per year." It may be reasonable to assume that about 400 inland natives in Keewatin use about 30 caribou per head, and the remaining 1,000 mainland coastal natives use about 9 caribou per head per year in addition to sea-food. The white residents take about 200 head, and, in 1942-43, the traders took about 500 head to provide skins for export to regions of scarcity farther east. The total annual drain upon the caribou by all residents of the Keewatin mainland is therefore probably not less than 22,000 head. Indians living south of the tree-line in Manitoba and Saskatchewan also draw upon these herds to an unknown extent each year. Wolves, accidents during migration, and disease take a further toll, but Blanchet(1) states that the natives of this region speak of the caribou as being unchanged in numbers and in general movements in so far as they recall.

Boothia and Melville Peninsulas

North of Chesterfield Inlet caribou are scarcer and the natives depend upon the sea for a large part of their food, but conduct caribou hunts inland to obtain skins for clothing. There are caribou on Boothia and Melville Peninsulas, but their numbers have undoubtedly decreased from native hunting in recent years. Manning(8) states that the migration across Rae Isthmus to Melville Peninsula has now ceased, at least on the east side of the isthmus, and the herds are not now replenished from the large reservoir to the south. All that remains now are a few small herds moving erratically about the southern part of the peninsula. In the northern part of Melville Peninsula they have become so scarce that the Igloolik natives are often forced to use sealskin and imported materials for clothing. These natives obtain some caribou by crossing Fury and Hecla Strait to Baffin Island, and some of them have recently moved to the east side of Foxe Basin where caribou are locally plentiful, having never been hunted until recently. In 1939 it was reported that caribou were very scarce on King William Island, and that none were ever seen on Adelaide Peninsula to the south. A report in 1940 states that caribou were present all winter on the southern part of Boothia Peninsula and the Isthmus, and that the few Eskimo there had no difficulty in securing a meat supply.

Southampton Island

On Southampton Island caribou were said to be quite plentiful prior to the opening of the trading post there in 1924. Some additional natives were brought to the Island from Coats Island when the Hudson's Bay Company post at the latter island was closed. The increase in population and excessive hunting with readily available ammunition appears to have so depleted the caribou that by 1935 it was estimated that only a few dozen animals remained, confined to the more rugged northeastern section of the island.(9) These small herds have multiplied in the protection of the hilly country and are again being hunted when they leave the sanctuary of the hills. Thirty-five were taken in 1942 and twenty-seven in 1943.

From the above noted R.C.M.P. reports it would appear that each native family could use about 25 caribou skins per year for clothing alone, or an estimated 5 skins per person. The 140 natives on Southampton Island could therefore use about 700 skins per year. On the basis of a natural increment in caribou of 15 per cent per year,(3) it would take a herd of approximately 4,500 head to supply the local demand for skins for clothing, without depleting the stock. It is not known what proportion of the island's 16,000 square miles will support caribou, but it seems quite probable the island could support a herd of this size. Since caribou meat is favoured by most natives, there is a natural tendency when caribou are plentiful to take more animals than are required for clothing alone. As previously stated, the caribou-Eskimo of the interior mainland draw heavily upon the caribou for all purposes, including dog food. On Southampton Island walrus and seal are readily obtained as a source of meat supply and

to augment clothing, and since walrus meat is much preferred as dog food it is unlikely that the drain on caribou, if available, would ever approach that of the caribou-Eskimo. At the present time the shortage of caribou meat is not a serious factor, since other sources of meat are available, but the shortage of sufficient skins for clothing causes some hardship. The Hudson's Bay Company imports caribou skins from other regions when available, but it is rarely possible to secure enough.(9) Questionnaire replies indicate that about 100 skins were imported in 1942-43.

Coats Island

Coats Island has several small herds of caribou. There has been no trading post or permanent resident on this island for a number of years, but, at intervals, when the herds have increased sufficiently, natives come from Southampton Island in whale boats and secure as many animals as possible to augment the supply of skins for clothing. This island comprises about 2,000 square miles, but unpublished reports by Dr. M. O. Malte in 1928, and A. E. Porsild in 1930, both botanists of the Victoria National Museum, seem to indicate that much of the interior is barren and that only narrow fringes along the coast at certain points support sufficient vegetation for caribou. One such area of good grazing land apparently exists at the south end of the island behind Carey's Swan Nest, where Captain H. T. Munn(11) reported the fattest caribou he had ever seen. The interior of the island and its grazing capacity have never been explored.

Baffin Island

Caribou are found over wide areas on Baffin Island, but the main herds remain in the interior around and north of Nettilling Lake. A few venture through the mountainous country to the east coast where the occasional caribou may be obtained throughout the year, but particularly in winter. In order to get skins in the late summer when they are in prime condition for clothing, however, it is necessary for the natives to proceed inland through the mountains. Land travel at this season is very difficult, and the result is that some families do not get enough skins for all purposes and have to rely on substitutes to some extent.

There are three natural factors which tend to protect the caribou in the interior of Baffin Island:

a) The long distances and the rough country which must be traversed to reach the interior.

b) In summer the Eskimo must walk inland to hunt and pack out the kill on his back.

c) In winter he is busy hunting seals and trapping foxes. In order to go inland he would have to obtain sufficient seal or walrus meat to feed himself and his dogs on the trip. Since the coastal Eskimo prefers seal meat to caribou except for an occasional change of diet, there is little inducement to go inland after caribou during the winter when the skins are unsuitable for clothing.

(Caribou Questionnaire, R.C.M.P., Pangnirtung, May 15, 1935)

R.C.M.P. reports and questionnaires by the Administration and the Hudson's Bay Company indicate the relative abundance of caribou in different parts of Baffin Island in recent years.

On Foxe Peninsula and along the south coast to Amadjuak Bay caribou are reported to be very scarce or entirely absent. At Lake Harbour they are never numerous, but a few small herds were seen in the spring of 1942. East of Lake Harbour scattered caribou are found along the coast at certain seasons. The average annual kill at Cape Dorset is about 10, and at Lake Harbour about 50. Skins are imported from other regions by the traders and sold at cost to the natives to supplement their meagre local supply. A number of former residents of Cape Dorset now live in the Igloolik district and hunt north and east of Foxe Basin. These natives annually trade about 200 skins with the Cape Dorset natives. It has recently been reported that about fifteen Cape Dorset families now hunt inland to Amadjuak and Nettilling Lakes, living off the caribou and taking two years to make the round trip. These people have camps on Nettilling Lake.

Around Frobisher Bay and the west end of Cumberland Sound sufficient caribou are found within a radius of 75 miles in the fall and early winter to meet the needs of the coastal natives. From Home Bay to Pond Inlet the average annual take is about 800 head, and main reliance is upon the herds in the interior where organized hunts are sometimes conducted. A herd of caribou lives on Bylot Island. In 1941

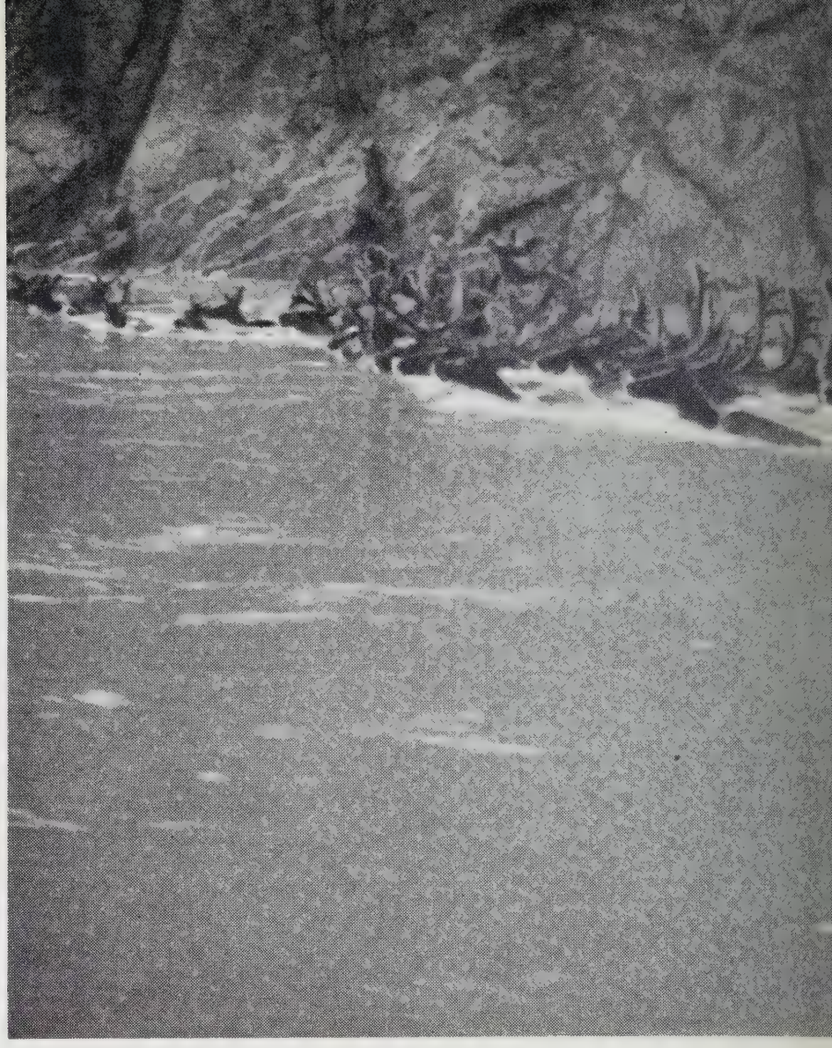


Caribou in migration swimming a stream.

the natives were able to secure 130 head on the east and north coasts of the island which are not always readily accessible.

Between Foxe Basin and Eclipse Sound caribou are apparently fairly plentiful, but no particulars are available as to the probable density of the animals per square mile. In the vicinity of Arctic Bay and on Brodeur Peninsula caribou are scarce, but the natives of Arctic Bay have recently obtained about 50 per year.

Manning(10) estimates the caribou population on a coastal strip 70 miles wide on the west side of Baffin Island from Koukdjuak River north to Piling at a conservative 10,000 head in summer, and



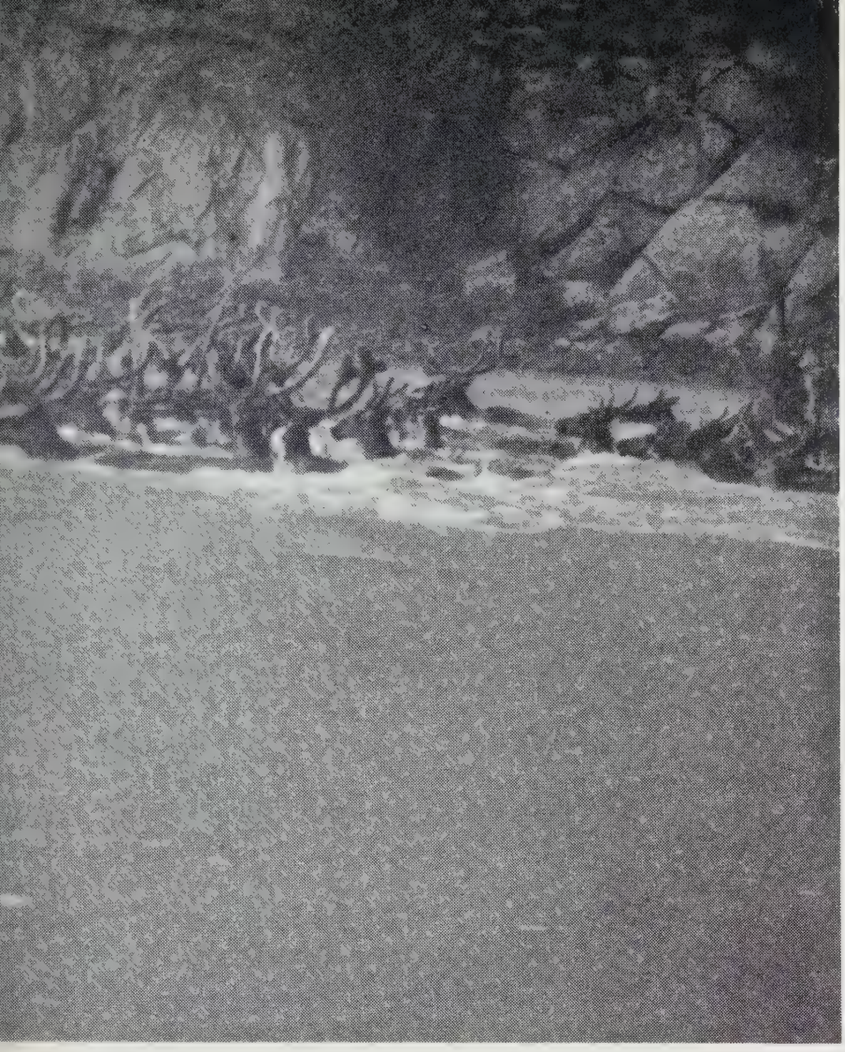
Caribou without antlers near Chesterfield



admits that there might be double this number. Soper(12) [page 66] states that the entire western plains on the island are deserted by caribou during the winter because deep hard snow covers all forage from November to early May. Manning(10) found that the caribou had left the flat lands before mid-October, probably migrating toward more hilly country to the northwest.

There appears to be some conflict in the reports as to the times and routes of migration of the interior herds, or else these have changed in recent years. Information received from the Royal Canadian Mounted Police at Lake Harbour in June 1944 describes a herd of about 1,000 to 1,500 head summering north of the west end of Frobisher Bay and wintering just east of Amadjuak Lake. A main herd of 12,000 to 15,000 is said to winter just south of Nettilling Lake and spends the period from May to September in the vicinity of Sadleq Island on the northeast coast of Foxe Basin. The southern trek of this herd is said to occur during October and the movement northwards in April. John Carrol and C. M. Duncan, land surveyors establishing mapping control points on Baffin Island in August 1943, saw very few caribou in their plane journeys in the region around Amadjuak and Nettilling Lakes and north to the Hantzsch River, which seems to support the view that caribou no longer spend their summers in this region.

The main reservoir for caribou on Baffin Island undoubtedly extends from Amadjuak Lake on the south up into the northern interior. Manning(10) uses a figure of about one caribou per square mile for the summer population east of Foxe Basin in his admittedly conservative estimate of 10,000 caribou for this region. Caribou are known to occur at all seasons in the interior north of this, over at least an additional 25,000 square miles. Some of the herds seen here no doubt have migrated from the southern plains region, but it might be safe to suggest that there is an additional 10,000 caribou in the North, and to estimate the total caribou



Centre:—Caribou swimming past steep rocky bank.

Male caribou with fully developed antlers. Females have smaller antlers.



population of Baffin Island as at least 25,000 head.

Clarke suggests 15 per cent as the probable rate of annual increase in the number of caribou in the region west of Hudson Bay, and further discounts this for natural mortality and depredations by wolves. Manning,(10) for the east coast of Foxe Basin, suggests an annual increment of 25 per cent, which he discounts to 20 per cent after allowing for losses from wolves and other natural agencies. Since wolves are less numerous per square mile on Baffin Island than in the caribou country west of Hudson Bay, and since they probably prey more upon the aged and defective animals than upon the prime productive ones,(10) it would perhaps be safe to assume that the net annual increment in caribou available for human use is at least 15 per cent, or say 4,000 head.

The Eskimo population of Baffin Island is about 2,000 persons, so that if the foregoing estimates on caribou are anywhere nearly correct, no more than two animals per person per year can be taken without depleting the herds. The following table, based on native game returns submitted annually by the R.C.M.P., indicates that the average annual rate of caribou consumption per person on Baffin Island during the past five years is well below the permissible rate for the island as a whole. The main trouble lies in the fact that concentrated hunting in some regions has so depleted the local supply that the annual take per hunter is very small, and insufficient skins are obtained to meet local needs. This tendency of the natives to deplete the local supply of caribou is a factor which must be considered in shifting native families to regions of richer game supplies. The table on page 11 gives a good idea of the relative plenty of caribou in different regions on Baffin Island, as shown by the rate per hunter and the rate per head of dependent population. For comparison, sample figures are also given for the caribou taken in Keewatin.

The total caribou reported taken by the white residents on Baffin Island does not exceed 75 animals per year.

Northern Quebec

Northern Quebec (Ungava) is, of course, not in the Northwest Territories. The natural resources are administered by the province, but the Indians and Eskimo in the region are the responsibility of the Federal Government. It is therefore desirable to briefly outline the status of the animals in the region, in so far as they affect the economy of native life in the Arctic sections of the province.

Caribou are now scarce in Arctic Quebec (Ungava), although they were apparently abundant throughout the peninsula up to the middle of the past century. Hudson's Bay Company records and the reports of early travellers indicate that there were three main migratory herds which supported three more or less distinct Indian bands south of the tree-line, and of course the Eskimo along the treeless coasts.(4)

A western herd travelled up and down along the coast hills east of Hudson Bay and was hunted by the Little Whale River Indians and others to the south. Some migrating offshoots of this herd populated Belcher Islands.(4) There have been no caribou on these islands for many years, and Flaherty(5) states the natives explained that the animals starved to death around the middle of the last century during an unusual winter, when heavy freezing rains covered with ice the forage plants on which the caribou depended for food. The mainland herd apparently also diminished to a state of great scarcity during the closing years of the century.

A central herd hunted by the Ungava Indians to the south passed near Fort Chimo each spring and summer.(4) Hudson's Bay Company accounts state that this herd numbered hundreds of thousands and was eventually depleted by wanton slaughter of the animals at the time of migration, by the Indians in the interior and the Eskimo of the coast. Fires which swept the country and destroyed the lichen on which the caribou grazed also speeded the decline of the herds. By 1905 caribou were becoming scarce, although even then the Indians are said to have slaughtered hundreds for the tongues and sinews alone.

The eastern herds occupied the upper George River and the Atlantic Highlands and Coasts, and supplied the Barren Ground and Davis Inlet Indians. These herds moved southwards in the autumn and northwards in the spring. The decline of caribou in this region began about 1905,

Luxuriant grass meadow near the outlet of Yathkyed Lake





Caribou herd near Carey Lake, Northwest Territories

and, by 1916, the customary migrations had ceased.(4)

There are, no doubt, several reasons for the decline of caribou in Ungava, and the subject is one worthy of careful study of all existing records and sources of information to ascertain what steps may be necessary to assist the recovery of the caribou population, which is so essential to the Eskimo and Indian natives. Excessive and unnecessary slaughter by both Indians and Eskimo, with the introduction of the repeating rifle, was no doubt a contributing factor in the decline. Forest fires were

Baffin Island

Region	Average no. of hunters	Caribou taken per hunter	Total caribou taken annually	Approx. no. of natives dependent	Caribou per person
Pond Inlet (Incl. R. Clyde, Home Bay and Arctic Bay)	133	6	800	500	1.6
Pangnirtung	100	3	300	550	0.5
Lake Harbour (Incl. Frobisher Bay)	90	0.6	50	450	0.1
Cape Dorset	80	0.13	10	330	0.03
**Foxe Basin Coast*	25	8.0	200	150	1.3

(*) Probably incomplete as to number of hunters and caribou taken.

Keewatin District

Region	Average no. of hunters reporting	Caribou taken per hunter	Total caribou taken by hunters reporting	Dependents at 5 per hunter	Caribou per person
Eskimo Point	40	40	1,600	200	8
**Baker Lake*	65	43	2,800	325	8.6

(*) Probably incomplete and includes a number of coastal natives.







apparently common at the time of the caribou decline. Low(6) describes extensive fires, many of which were caused by the carelessness of the Indians in using signal fires. Burwash(2) describes a fire 250 miles long by 100 miles wide which destroyed caribou food for 100 miles southeast of Richmond Gulf in 1921. Such extensive fires, besides reducing grazing areas, could halt caribou migrations and cause the loss of herds from unsatisfactory winter food conditions. It is estimated that it takes from 15 to 20 years to replace reindeer range after it is overgrazed.(7) Burned areas probably take 25 or more years to recover. Winter rainfall and frozen-over food supplies could also work in combination with halted migration caused by forest fires, or excessive hunting along the migration paths, to deplete the herds by starvation.

The true extent to which the caribou were depleted in Ungava is not known. Even at the lowest ebb there were known to be scattered herds in the interior which remained in the more inaccessible regions and no longer followed their migrations to the coast. There have always been caribou herds on the upper reaches of George River, and around Lake M nto and Payne Lake they could always be found, but, apart from the occasional small wandering herds in the vicinity of the coastal settlements, it has, for many years, been necessary to go far inland to secure skins for clothing. As a result there are never enough skins, and these have to be imported by the traders.

Replies to questionnaires give some indication of the status of caribou during the period 1940—43:

At Fort Chimo about 80 caribou are obtained in February and March from Whale River, 40 miles distant. Some additional skins are imported from the George River area. Reports by air pilots indicate that numerous herds were seen from the air in the interior. The local opinion is that the supply is increasing.

The natives at Payne Bay and Wakeham Bay obtain about 30 and 20 caribou respectively during the winter, from about 200 miles inland. There is a demand for imported skins when they are available. No caribou are obtained at Sugluk, Wolstenholme, or Cape Smith.

The Povungnituk natives obtain about 50 to 100 animals in the Payne Lake region, 200 miles distant, during the winter.

Top:—A shooting blind used by Eskimo, Kazan River, Keewatin District.

Centre:—Muskeg spruce forest east of Mackenzie River — an excellent type of winter range

Left:—Eskimo with pack dogs starting a caribou hunting trip from Baker Lake.



Caribou swimming Thelon River.

About 100 skins are imported annually by the traders.

There are a few scattered caribou around Port Harrison, and the natives get about 150 animals at Lake Minto, 150 miles inland, in the spring and fall. About 250 skins are imported by the traders.

In the foregoing an attempt has been made to summarize the principal known facts in regard to the status of barren ground caribou in the Eastern Arctic. It is apparent that in many areas there is a serious shortage of caribou skins for clothing, which could probably be relieved by more intensive game management. The form of management best suited to this country of great expanses and a thinly scattered aboriginal population could only be decided upon by competent authorities, in the light of further factual information than is at present available. This would involve intimate studies of the life history of the caribou, its predators, and the topography and grazing facilities in the regions concerned. For the present, the Administration is endeavouring to alleviate the scarcity of skins for clothing by importing reindeer skins from the highly successful Government Reindeer Station at the mouth of the Mackenzie River. As these reindeer skins become more plentiful it is possible that the shortage in caribou skins may be largely made up from this source.

Polar Caribou

North of Lancaster Sound and Barrow Strait the islands of the Canadian Arctic Archipelago are populated by a smaller race of caribou, which is paler in colour than the barren ground caribou in the more southern regions. On some of the islands along the northern fringe of the region occupied by the barren ground caribou the animals are said to be smaller than those found farther south, and it is possible these are a mixed breed of barren ground and polar caribou. These smaller caribou are found on Boothia Peninsula and on Somerset and Prince of Wales Islands. It is said that about thirty of these animals per year are required for clothing a family of five or six persons.

There are no people living at present north of Lancaster Sound, but R.C.M.P. patrols in past years indicate that polar caribou are fairly numerous on Ellesmere, Axel Heiberg, Amund Ringnes, Cornwall, and smaller islands south of these. They are also found on many of the western islands of the Archipelago. There is no information as to the density of the polar caribou population or its annual rate of increase, but it seems probable that these animals, living in a region for all practical purposes untouched by man, have reached a state of biological balance, and are not likely to change greatly in numbers so long as conditions remain as they are.

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NOTE: Further sections under Economic Wildlife of the Eastern Arctic will appear subsequently.



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Eskimo Population in the Canadian Eastern Arctic

(*Reprinted from the CANADIAN GEOGRAPHICAL JOURNAL, September 1944*).



SCARCITY OF CAMPS IN THE AREA WEST OF HUDSON BAY IS PARTIALLY DUE TO LACK OF INFORMATION

ESKIMO POPULATION IN THE CANADIAN EASTERN ARCTIC

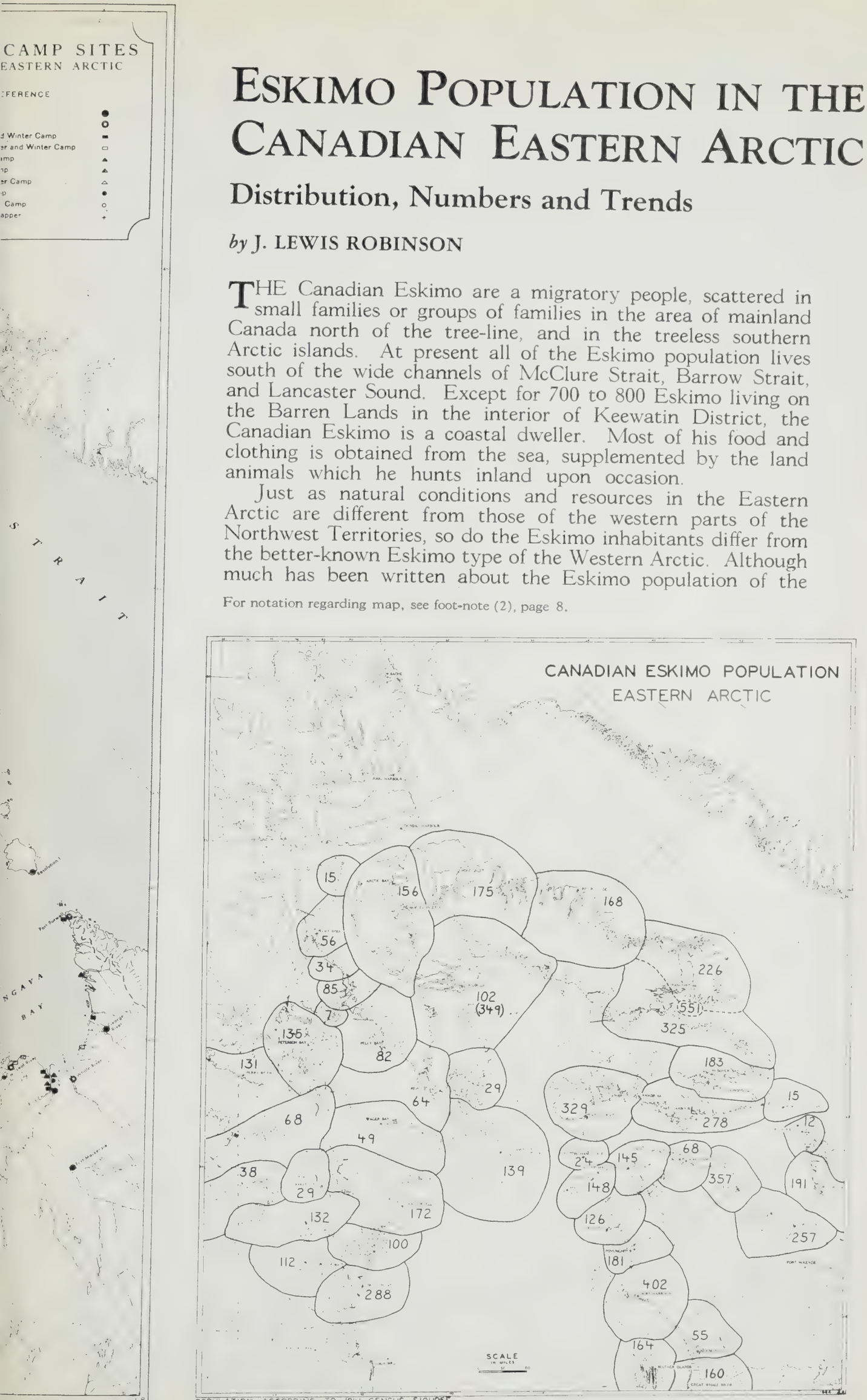
Distribution, Numbers and Trends

by J. LEWIS ROBINSON

THE Canadian Eskimo are a migratory people, scattered in small families or groups of families in the area of mainland Canada north of the tree-line, and in the treeless southern Arctic islands. At present all of the Eskimo population lives south of the wide channels of McClure Strait, Barrow Strait, and Lancaster Sound. Except for 700 to 800 Eskimo living on the Barren Lands in the interior of Keewatin District, the Canadian Eskimo is a coastal dweller. Most of his food and clothing is obtained from the sea, supplemented by the land animals which he hunts inland upon occasion.

Just as natural conditions and resources in the Eastern Arctic are different from those of the western parts of the Northwest Territories, so do the Eskimo inhabitants differ from the better-known Eskimo type of the Western Arctic. Although much has been written about the Eskimo population of the

For notation regarding map, see foot-note (2), page 8.







Mackenzie delta and Coronation Gulf area, these natives represent only about one-fifth of the total Canadian Eskimo population. The bulk of the Eskimo population lives in the Eastern Arctic, where difficulties of the natural environment limit the visits of white men to a short period each year.

The present Canadian Eskimo population is not a homogeneous people. Those of the Western Arctic have been more affected by civilization than any other Eskimo group. Many of them are relatively prosperous, wear white men's clothes much of the time, and carry on business with ease with the traders of the area. Some of the Eskimo themselves are full-time traders. The Eskimo of the area are a mixture of inhabitants of the old Thule Eskimo culture, plus a newer group who have come in from Alaska. To both has been added white blood from the people coming down to the mouth of the Mackenzie River or whaling in Beaufort Sea. The contact with civilization over the past many decades has given this group of Eskimo an outlook and culture different from that of the remaining Eskimo population.

On the other hand, the Eskimo of the Central Arctic—the area around Perry and Back Rivers, King William Island and Boothia Peninsula—have been relatively inaccessible by boat due to ice conditions

Top:—Lake Harbour pilot "Navolio"
Photo by R. Grandy

Centre:—John Ell, native pilot for the harbour, Southampton Island

Below left:—Patsy Klengenberg and family, at Fort Ross. He is a successful half-breed trader from the Western Arctic.

Below:—Unloading supplies at Pangnirtung. R.M.S. *Nascopie* in background





which impede transportation. They still retain much of their primitive culture, depending greatly upon the animal resources of land and sea for their food, clothing and utensils. The advantages and ills of white civilization have reached them to only a limited extent, leaving this Eskimo group with a type of culture and isolation similar to that of the ancient Eskimo inhabitants of the whole area.

Although it is difficult to generalize over an area as vast as the Eastern Arctic, it may be said that the Eskimo inhabitants of this region are in a stage of contact with civilization intermediate to the two smaller groups to the west of them. During the period of exploration for the illusive Northwest Passage in the seventeenth and eighteenth centuries, and through the whaling days of the nineteenth century, Europeans were visiting this region. However, the inhospitable natural environment always checked any one from staying in the area for more than a few years at a time. The Eastern Arctic Eskimo has thus been able to obtain many of the utensils and implements of white civilization, but still keeps much of his old mode of living, which is a successful adaptation to the limitations of his environment.

No attempt will be made in the following presentation to discuss the origin or qualities of the Eskimo population, since much has been written about these factors. The purpose of the introduction is to point out that such descriptions must be qualified geographically as to the area to which they refer, and to illustrate that the Eastern Arctic Eskimo differs from the native inhabitants of other Canadian Arctic areas. Much of the following information is new material which is presented as a basis for understanding the Eastern Arctic Eskimo population. In any future planning for the welfare of the native people these basic facts of distribution, numbers and trends of the population are fundamental in appreciating the difficulties of administering this region.

Present Population

As a result of the census tabulations of 1941, in which nearly all Eskimo were recorded in the census books and given a numbered fibre disk to solve the problem of uncertain spellings and the repetition of the same name within a group, a fairly accurate picture of the numbers and distribution of the Eskimo population is now available. The fact that this had not been done accurately before only illustrates the problems of trying to count a migratory people in a vast, remote and thinly-populated area. Because of the problems of limited transportation facilities to certain areas, some of the census books were not returned until the spring of 1943, and, in the case of Igloolik, the books arrived too late to be included in the final official census. When these later figures are added to the official total of 7,392, and allowance is made for the fact that undoubtedly some natives were missed in the tabulations, the figure of 7,700 is probably a fairly accurate minimum estimate of the present Canadian Eskimo population. Since they are spread over an area of 872,000 square miles north of the tree-line (exclusive of the area of the far northern islands where the Eskimo do not live), they occupy the region with an approximate density of population of one Eskimo for every 115 square miles.

Of the 5,404 Eskimo (or half-breeds listed as Eskimo) living in the Northwest Territories, 1,582 are in the Western Arctic and the remainder live in the eastern sections, serviced from the Atlantic or Hudson Bay. If one adds to this latter group the 1,965 Eskimo for whom the Northwest Territories Administration is responsible in Northern Quebec, there are about 6,000 Eskimo in the Eastern Arctic (about 80 per cent of the Eskimo population). Only 23 Eskimo are listed as living in the other provinces, chiefly northern Manitoba.

Regional Distribution

The regional distribution and density of the Eastern Arctic Eskimo population may best be shown by comparing the accompanying map of Eskimo population (P.3) with the following table showing the approximate number of square miles of land area and miles of coast-line available for each Eskimo. Although the natives are primarily coastal inhabitants, doing much of their hunting in coastal waters or on the strip of sea-ice along the shores, they also use the interior land area whenever possible, so that both figures should be considered in comparing relative densities of population. (*See* table at bottom of next page).

In Keewatin District there is a balanced adjustment between the population and the wild-life resources of the area. Although there is a smaller mileage of coast-line per Eskimo, probably more than half of the native population are the so-called 'Caribou Eskimo' who live inland most of the year, obtaining much of their food and clothing from the caribou of the land and the fish of the numerous lakes and rivers. This combination of inland and coastal Eskimo is possible because of the geographic character of the region, which has ample lowland area and adequate vegetative cover. The distribution of the Keewatin Eskimo is probably a wise balance of nature, and the result of centuries of living off the land. Any large increase in Eskimo population would probably crowd the region, resulting in depletion of the caribou herds, or would necessitate the importation of more white man's food, which is considered detrimental to the welfare of the Eskimo.

Southampton Island appears to be sparsely populated for its relatively large area and miles of coast-line. Much of the interior, however, is of little value because the caribou population has been almost depleted within recent years, causing the natives to obtain most of their food and clothing from the abundant sea life, chiefly along the south coast.

Baffin Island is the largest of the Canadian Arctic islands, and has a fairly large Eskimo population fringing its coasts. A more accurate picture of the distribution of this population is obtained when one realizes that two-thirds live in southern Baffin Island and many parts of the interior areas of the island are unproductive or unused. A high, rugged mountain range which extends along the northeast coast from Pond Inlet to Cumberland Sound tends to make inland travel difficult. In addition, the extensive lowland area on the central west side of Baffin Island is relatively inaccessible by foot to the native population, who would like to cross to that district in late summer when caribou hides are at their best for clothing. This relative unproductiveness, however, is balanced by the fortunate fact that Baffin Island is greatly indented with many broad bays and numerous long, narrow fiords, giving the Eskimo access to many miles of coast-line and their staple food of seal meat and fat.

Several Eskimo families from southern Baffin Island were brought into the Somerset Island-Boothia Peninsula area when the trading post at Fort Ross was opened in 1937. Here they have mixed with the more primitive people of this region, which appears to have adequate game resources for both groups. The

DENSITY OF POPULATION

REGION	Population	Sq. Miles	Miles(1) of Coast-line	Sq. Miles per Eskimo	Miles of Coast-line per Eskimo
Keewatin (N. of tree-line, incl. Melville Pen.)	1,400	218,000	5,400	151	4
Southampton Is. (incl. Coats Island)	139	18,000	1,000	130	7
Boothia Peninsula and Somerset Island	200	22,000	1,550	110	8
Baffin Island	2,000	200,000	11,500	100	6
Ungava (mainland of Quebec N. of tree-line)	2,100	92,000	3,200	44	1½
Ungava (incl. offshore islands of N.W.T.)	2,300	98,000	4,300	43	2

(1) The coast-line has been measured from the new 8 miles = 1 inch air navigation sheets. The total does not include small inlets or offshore islands and thus is a minimum figure. All large bays, inlets and islands were included.



Hauling white whale hides, Pangnirtung.

shores of Somerset Island and Boothia Peninsula, with an average of 8 miles of coast-line per Eskimo, present wide possibilities for food and may well be an area which will be favourable for absorbing the excess population of the more crowded sections of southern Baffin Island and Northern Quebec.

In the former Ungava District—the Arctic section of Northern Quebec north of the tree-line—it is known that relief costs are relatively high, and the welfare of the Eskimo is not as good as in some other sections of the Eastern Arctic. One of the reasons for this condition is found in the fact that there is a density of population in which each Eskimo has only 43 square miles of land area and two miles of coast. (This includes the population, area and coast-line of the offshore islands, which are actually part of the Northwest Territories.)

This region appears to be definitely overpopulated in comparison with other areas of Canadian Eskimo population, and under present game conditions.Caribou have disappeared from some areas and are scarce in others, while the resources of the sea and the limited fur catch have not been sufficient to supply food to these numbers. This has necessitated the issuing of relief rations at nearly all of the posts. Although it is realized that Ungava is overpopulated, the Eskimo are human in that they do not like to move to an unknown region. Thus it may be that the

Eskimo handling stores at Cape Dorset, Baffin Island, after ship's departure.



Eskimo women carrying supplies.
Photo by R. Grandy



answer to bettering the welfare of the native people lies not in redistribution, but in attempts to increase the game supply. The Eskimo problem of Northern Quebec is accentuated by a political problem in that the jurisdiction of the Northwest Territories Administration and the Province of Quebec overlap here.

This regional survey of the distribution of the Eskimo population illustrates that they are not evenly dispersed throughout the Eastern Arctic, and thus any planning for the future welfare of the Eskimo will first have to consider areas of greatest density. Even within the local regions, however, the Eskimo are a fluid, migratory people, moving from one seasonal camp to another. Their seasonal hunting and trapping activities, which are co-related with the habits of the local wild life, make them a difficult people to whom to bring education and medical attention. A more accurate picture of the distribution of the Eastern Arctic Eskimo population may be obtained from the accompanying map* of Eskimo camp-sites, which shows the position and type of Eskimo camps as of 1943. (2) A discussion of the function of these camps illustrates the general seasonal round of activities of the native population.

Eskimo Camp-sites and Seasonal Activity

Although no Eskimo camp-site may be classed as permanent or certain, there are some places where the camps are used throughout the year and they usually remain in the immediate vicinity of some favourable hunting spot for several years. Although some of the families, or members of a family, may be absent from it for a time, there is usually some one there. Such camps are the closest approximation to a 'native village' that these migratory people have. They are quite common in the Cumberland Sound area and in northern Baffin Island, where they may contain anywhere from 20 to 50 Eskimo during certain periods. There are other camp-sites, which although in sufficiently favourable hunting areas to be used in both winter and summer, are only used occasionally or in alternate years. These are called occasional summer and winter camps.(3)

Usual summer camps are generally found at the same place for several years in succession but during the summer only.(4) They are quite often located on offshore islands or at the mouths of rivers, as illustrated in the Cape Dorset area and along the east coast of Hudson Bay. If the camp is on an island, it is from here that the Eskimo hunter pushes off in his wooden boat or skin kayak to hunt seals or walrus for his summer's food and winter's oil and dog feed.(5) A summer camp at the mouth of a river is so located as to permit fishing there in July when the fish are going out to sea, and again in September when they are running upstream to the interior lakes. Sometime during the late summer period some of the group will pack their skin tents, carry a

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(2) Information for the Eskimo camp-site map was gathered during the summer of 1943 chiefly by Lt. A. L. Washburn, Arctic Section, A.D.T.I.C., U.S. Army Air Force. He was assisted during the first half of the Eastern Arctic Patrol by Lt. T. H. Manning, R.C.N.V.R. on loan to the N.W.T. Administration, and by J. Lewis Robinson, geographer for N.W.T., on the last half of the patrol around Baffin Island.

The camps were plotted on large 8 miles = 1 inch work maps by the traders, missionaries, policemen and some Eskimo at each post, and for any additional area with which they were familiar. Since it was planned to use the data for rescue work and information for flyers who might be in that area, care was taken to see that the camp was located as accurately as possible. Only those camps were used for which there was a good possibility of some one being at the camp at the season named. Information obtained for the east coast of Ungava Bay and the west coast of Hudson Bay was incomplete. The location of additional camp-sites in the King William Island—Perry River area was supplied by the Hudson's Bay Company from Winnipeg.

A new base map of the Eastern Arctic was compiled and drawn up by the author at the Bureau of Northwest Territories and Yukon Affairs in Ottawa. It included all of the latest map and aerial photo information which was currently available. The camps were then plotted on this base by the author and sent to Lt. Washburn in New York for checking before being printed and reduced to the present scale.

(3) The occasional camps in the Igloolik area are so classified because of the uncertainty of the status of the camps since the closing of the trading post in 1942. The mission is still open there.

(4) Summer camp-sites which are less regular in location from year to year are designated on the map as occasional summer camps.

(5) The modern Eskimo boat, usually commercially manufactured, is equipped with a gasoline motor and the Eskimo makes a good mechanic. The skin kayak is little used on the west coast of Hudson Bay.

*See map on first page of article.



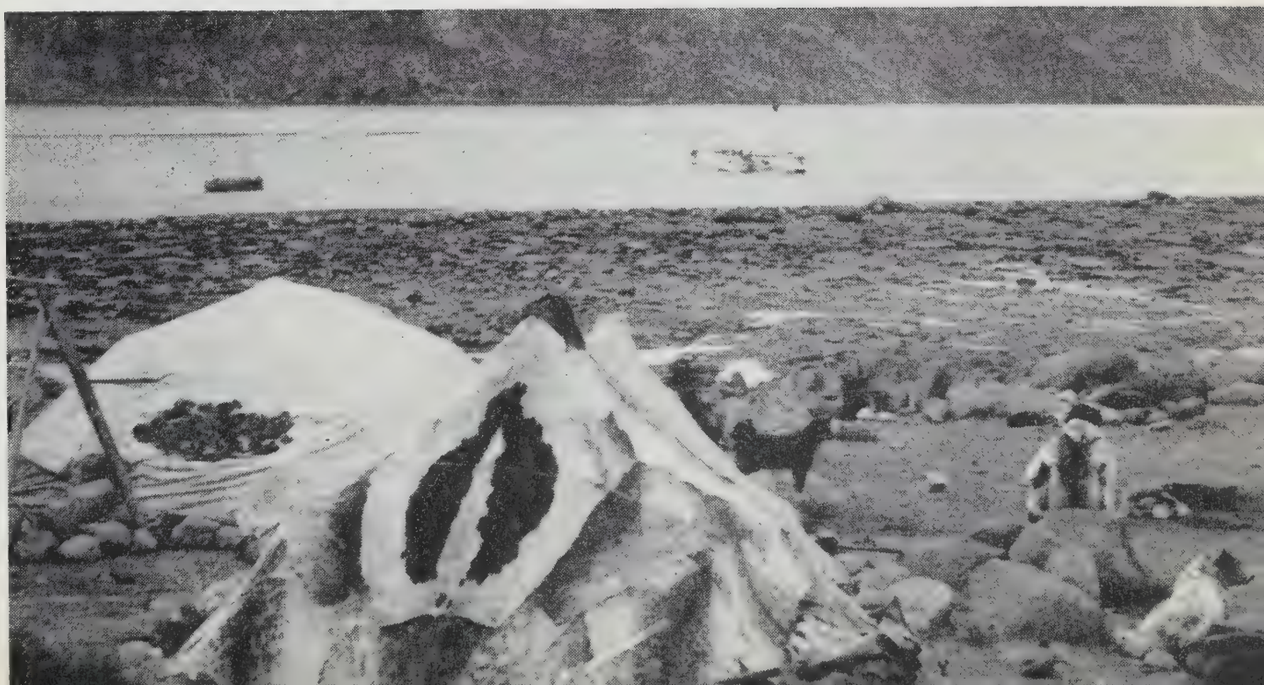
Eskimo sledge dog, Cape Dorset, Baffin Island



Native camps at Pangnirtung
Photo by Eric Fry



A Camp at an old abandoned Eskimo village of snow houses, Catherine Bay, Hudson Strait



Eskimo skin tent, Pangnirtung
Photo by Eric Fry



Native family in whaleboat at Lake Harbour

R.C.A.F. photo by Eric Fry

supply of food, and go inland to hunt caribou, the skins of which will later be made into winter clothing by the women.

The chief event of the summer is the coming of the annual supply ship. This occurs at approximately the same time each year, and varies from mid-July to mid-September, according to the position of the settlement on the route of the Eastern Arctic Patrol. About 'ship-time' the natives begin to move toward the post from scores of miles along the coast. It is a happy, carefree holiday for them as they put on their best clothes and manners to greet the white visitors and officials. It means an annual reunion—a chance to visit friends and relatives from other camps and to tell and be told the news of the past year. They help to unload the barges which lighter supplies ashore, and in return are paid in rations by the trading company while they are at the post. Within a few days the year's supplies are piled up on the beach and in the warehouse; the ship's whistle blasts a farewell, and the Patrol ship moves slowly out of the harbour, not to be seen again for another year.

In the Eastern Arctic, winter camps generally consist of dome-shaped snow-houses which can be constructed out of snow blocks by an expert Eskimo within an hour or so. They are left unoccupied when a family moves out and a new house is built at the next camping spot. There are certain locations, however, which are favourite hunting or trapping grounds, and at which 10 to 30 Eskimo may be grouped during most of the winter. It is quite probable that all will not be there at the same time, but that they will come and go as fancy or necessity demand. If the same place is chosen for several years the site becomes a usual winter camp, but if the camp-site varies from year to year it is an occasional winter camp. From these winter camps the Eskimo hunters go out on the sea-ice to wait patiently at breathing holes to harpoon or shoot seals, or in the spring to steal up within shooting range as the seals bask in the sun at the floe edge. Some winter camps may be located on the shore of an interior lake, where the family will fish for long weary hours with a hook or net through a hole in the thick ice.

Winter camps are also situated on a trap-line, and from mid-November to the end of March, when the open season for foxes ends, the Eskimo periodically visits his fox traps. The fox skins will later be brought into the post to be traded for the goods and necessaries which the white man has brought into his life. The Eskimo's prosperity will vary with the fox cycle, which is one of plenty about every four years. His catch will also depend on how much time he has to spend hunting seals or fishing for food. If he has a bad year he will be forced to ask the trader for credit to supply himself and his family with food until the next season.

There are other camps which are called spring camps.(6) They are usually well-known and excellent spring sealing camps, and are well illustrated in northern Baffin Island and along the east coast of Hudson

(6) Although these spring camps are found under winter conditions they are usually unoccupied for half of the season and could not be classed as winter camps with the expectation of finding some one there most of the winter.



Finish of kayak race, Port Burwell

Bay. The spring camps supply food for that season and also much material for summer clothing, which is principally sealskin for boots and pants, and sometimes parkas. Late spring is usually a happy time in the Eskimo's life. The days become longer and warmer; birds begin to return and add variety to their diet. Food is generally plentiful and the Eskimo has a chance to relax after a long winter of hunting and trapping.

Since the Eskimo population of the Eastern Arctic attempts to support itself from its environment, much of the distribution of the native people can be correlated with areas of abundance of wild life. Most of the natives are coastal dwellers because the food of the sea is more abundant and reliable than that found on the land. Just as the game of the land and sea is continually moving to find sufficient food, so is the Eskimo population a migratory one, with certain regional areas of density within which there are local movements and fluctuations. These habits, which are an adaptation to the limitations of their natural environment, bring forth many problems in administration and welfare. To approach these problems intelligently one of the prime requisites is to know the facts of where the natives may be, in what numbers, and what are their seasonal activities.

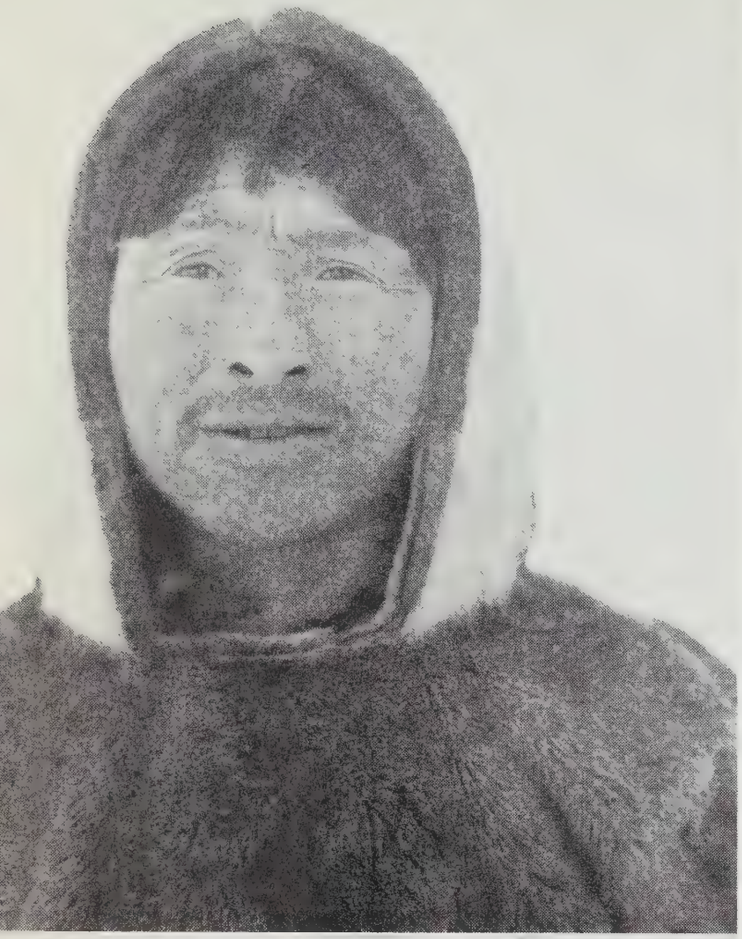
Trends

It is difficult to state exactly how much the Canadian Eskimo population is increasing, since available vital statistics are admittedly incomplete. These returns are submitted annually by the Royal Canadian Mounted Police detachments at various Arctic posts, and were especially poor in the early years when the Eskimo had less contact with government representatives. Certain trends and percentages, however, give an indication of the status of the population, and since they are all the figures that are available, it is the best that can be done.

Some authorities believe that the Eskimo population has declined greatly since the coming of the white man; and this is probably true if they have followed the pattern illustrated by the contact of other native peoples with civilization and its diseases. It seems quite probable that before the whites came upon the scene there would be a balance achieved between the population growth and the game resources of their inhospitable land. Infant mortality, and starvation when their primitive weapons failed to kill enough game, would be positive checks upon the population. When white men first began moving into the Arctic regions, the contact with the diseases of civilization, for which the Eskimo had no immunity, would certainly kill off numbers of their population. However, early statements concerning the Eskimo population, based on numbers of these migratory people met at various scattered places, may be misleading, and it is only within the present century that estimates have become more accurate.

Along the coasts of the Western Arctic evidence points to the fact that the Eskimo population has declined within the past forty years. There now appear to be fewer people in the interior Barren Grounds since the time of Rasmussen's Fifth Thule

Below:—"Kavivo", Cape Dorset, Baffin Island





Above:—Grandmother, daughter and grandsons. Natives of Cumberland Sound camp



Left to right:—William Duval's eldest daughter, his widow (totally blind), Al-ook-ee, Duval's youngest daughter

explorations (1922—24).(7) Whether this has been an actual decline, or simply that the people have shifted to the coasts to be nearer the trading posts, is difficult to determine from our present knowledge. On Baffin Island, on the other hand, Major Burwash, special investigator for the Northwest Territories, estimated that the Eskimo population was 1,800 in 1925. The present population of 2,000 indicates that these people have been able to carry on adequately. Over the whole Arctic area there has been an increase on paper since the 1931 census, which listed the Eskimo population as 5,979; but at that time it was realized that the figure was incomplete and in many cases was only an estimate.

Although the present available statistics can only indicate the present and recent-past status of the Eskimo population, it would seem that the present-day natives,

(7) Kaj Birket-Smith. *The Caribou Eskimo I-II*. Report of the Fifth Thule Expedition. Vol. 5. 1929

Below:—Kaoomoo, old Eskimo, River Clyde
Photo by R. Grandy





Native women resting in front of Hudson's Bay Company warehouse, Wakeham Bay, Quebec.

armed with more efficient weapons and importing outside food, should be able to maintain themselves against the natural rigours of a poorly productive country. Total births and deaths for the period 1927—43, as shown in the table, on opposite page, indicate that the Eskimo population is slowly increasing at the rate of one per cent annually. (8)

Birth rates are fairly high among the Eskimo. During the period 1936—40 the average annual birth rate was 35 per 1,000. This compares favourably with the lower rates of 20 births per 1,000 for all of Canada during the same period. Of the recorded births during the total period 1927—43 it is found that 54 per cent of the births were males, with male births being

(8) These figures include data from areas tributary to Baker Lake, Chesterfield, Lake Harbour, Pangnirtung, Pond Inlet, Cambridge Bay and Coppermine. Also shorter term data from Eskimo Point, Southampton, Foxe Basin, Dundas Harbour, Craig Harbour and Bache. The total Eskimo population of this region is about 4,500.

Below:—Eskimo family, Southern Baffin Island
Photo by Eric Fry



Below:—Eskimo woman, "Pitulala", Lake Harbour, Baffin Island

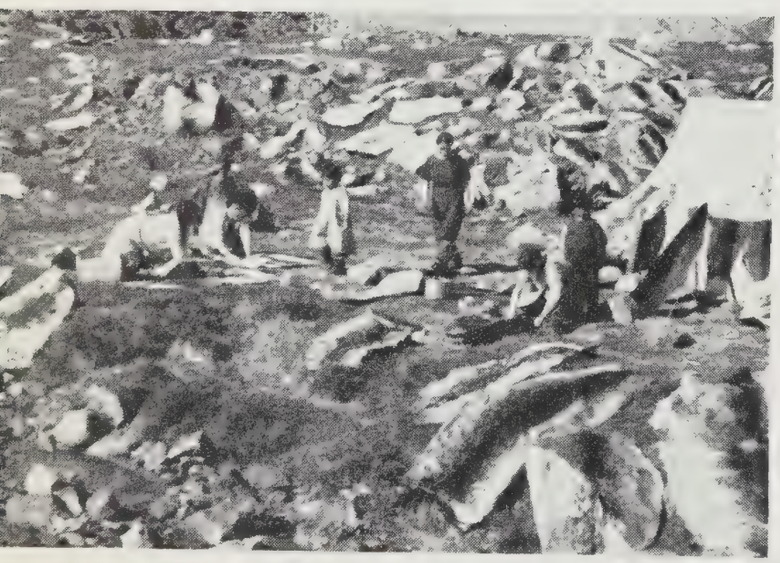




Above:—Sarah (daughter) and Maggie (mother, seventy years), at Wolstenholme, Quebec
Photo by R. Grandy









slightly predominant at each of the areas from which statistics were sent. The accompanying chart of Eskimo births by months illustrates that the three winter months of January, February and March have the highest number of births recorded, while fewer births have been noted in the autumn. It would thus appear that the period of greatest fertility occurs in the spring when living is easier and food generally more plentiful than during the difficult winter months.

Infant mortality is usually high among primitive people, but with the present Canadian Eskimo it is not as serious as one might expect, despite their lack of modern medical facilities. Records show that infant deaths (under one year) constituted 21 per cent of the total deaths during the period 1927—43. A more reliable figure is obtained from the Eskimo records of 1936—40, in which infant deaths were 24 per cent of the total deaths. The accompanying chart* compares these figures with percentages for the rest of Canada, and illustrates that although the Eskimo death rates are higher, they are not excessive. The infant mortality problem, however, becomes more serious in comparison with the rest of Canada when one discovers that Eskimo infant deaths were 17 per cent of the total births during both periods of 1927—43 and 1936—40. These figures indicate that for every 100 Eskimo births an average of 17 die before they are one year old.

Death rates are also high in the Eastern Arctic. In the five years, 1936—40, when Eskimo statistics are more reliable, the

*See page 15

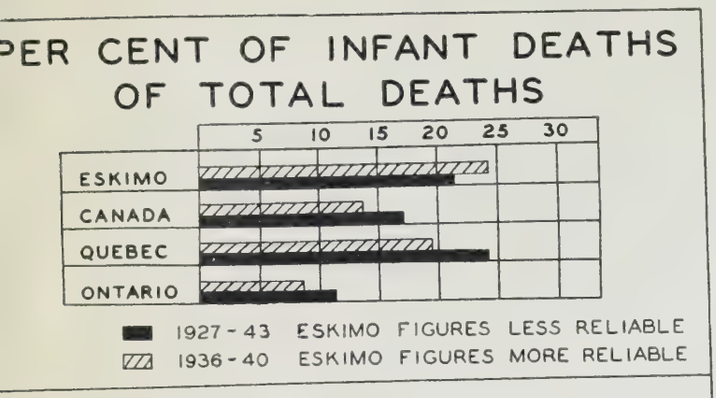
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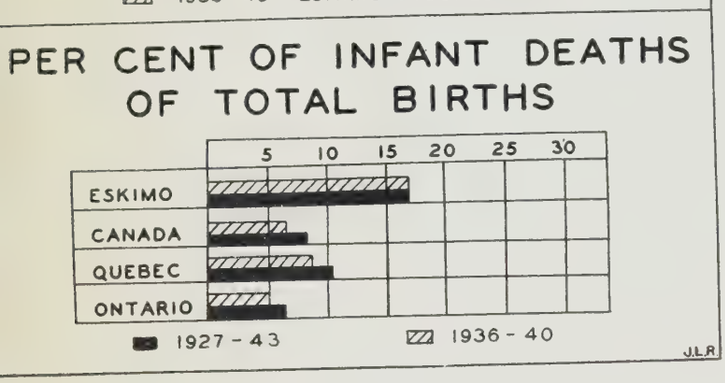
Eskimo spearing Arctic char, fish trap, native encampment, Boothia Peninsula.

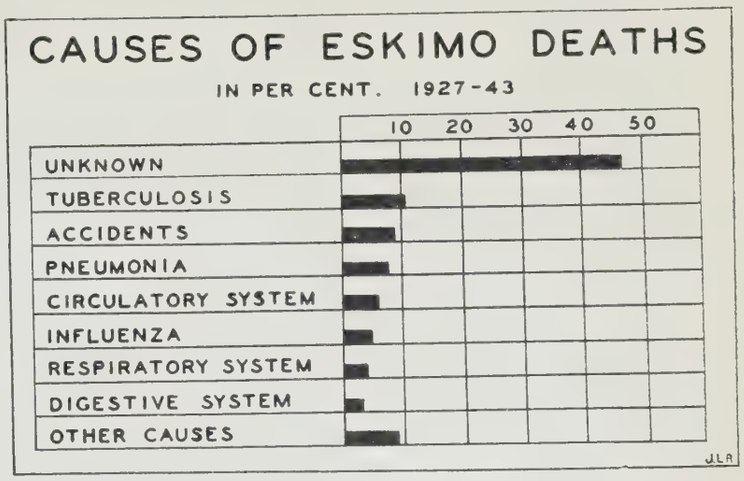
Party of natives skinning ptarmigan, Terreokjuk, Baffin Island.

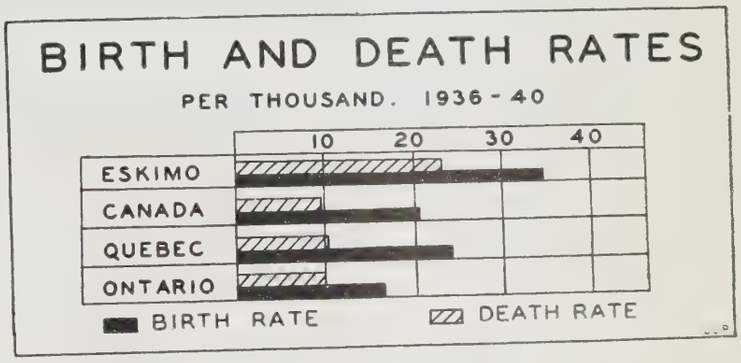
Cleaning and drying sealskins.
Photo by Eric Fry

Eskimo woman cleaning blubber off skin of white whale at Pangnirtung, Baffin Island. Employed by Hudson's Bay Company.





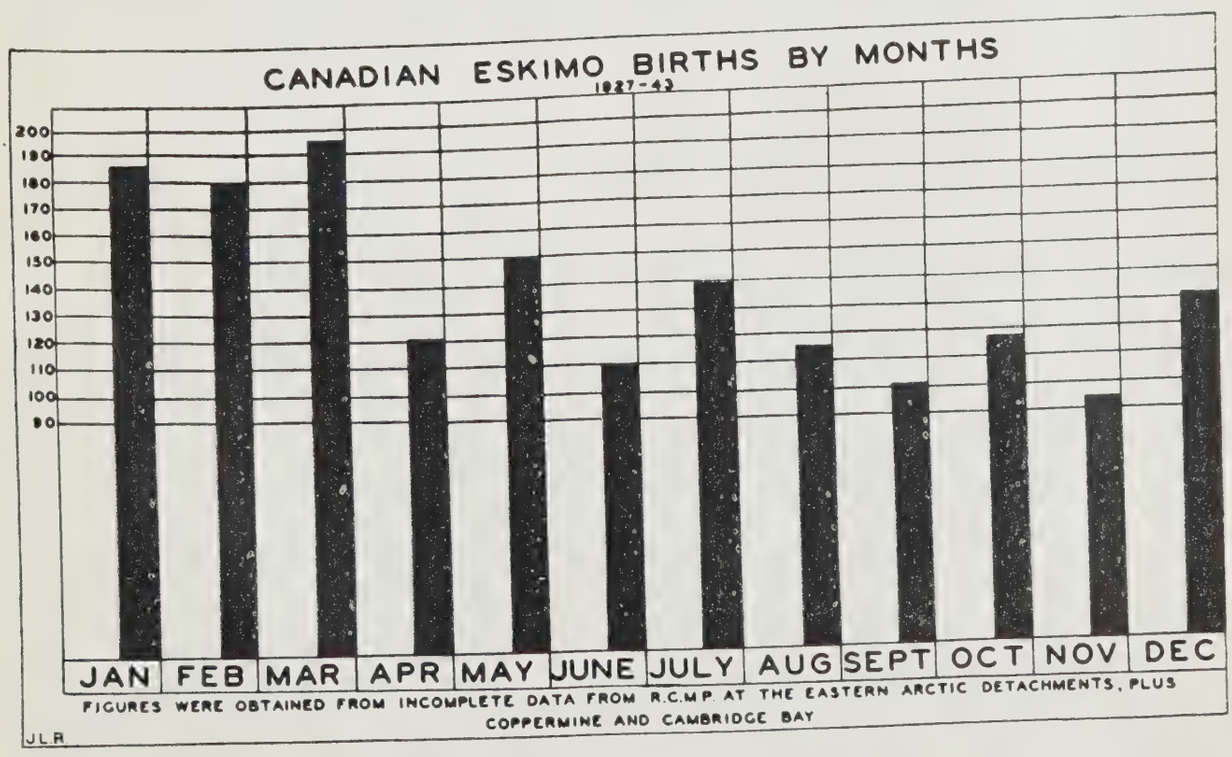




ESKIMO BIRTHS

DEATHS

Date	Male	Female	Total	Still births	0-6 months	6-12 months	Total infants	Others	Total	Net increase
1927-43.....	970	814	1,784	28	167	107	302	1,132	1,424	360
1936-40.....	...	...	787	12	80	42	134	409	543	244





Government-supported hospital of Anglican Mission at Pangnirtung, Baffin Island, Northwest Territories

R.C.A.F. photo by Eric Fry

death rate was 23 per thousand. (The average for Canada was 10 per thousand.) Although the R.C.M.P. officers have good first aid training and give a great deal of medical assistance to the natives whom they visit on their patrols, it is not to be expected that they would be able to diagnose the cause of most deaths, particularly when they are not present when death occurs. Thus, one finds that the chart showing causes of Eskimo deaths states that 46 per cent of the total of 1,424 deaths are listed as unknown. A growing medical problem is illustrated in the fact that the leading known cause of death is found in the 10.5 per cent who have died from tuberculosis. The next largest group, and typical of the dangerous life which the Eskimo leads in his quest for food, is the 9 per cent who have died due to accidents. The other known causes are similar to those which cause death among any group of people.

Since the last complete census in 1941, the records are too short to prove anything concerning the status of the population, but they are valuable in completing a statement of the known facts. There have been 268 births in the Eastern Arctic (including incomplete returns from Northern Quebec), which is about normal and maintains the high Eskimo birth rate. The most serious problem facing the Eskimo population, however, is the sudden appearance of epidemics which wipe out numbers of their population in local areas. Since 1941 several epidemics have been chiefly instrumental in causing 304 deaths in the Eastern Arctic and thus actually reducing the population by 36 persons. In the Western Arctic there were 79 births recorded and only 51 deaths, which has meant an increase of 28 Eskimo since the 1941 census.

Although vital statistics returns, the only actual data which can be used, show that the population on the whole has slowly increased in the years since the Administration of the Northwest Territories has taken an active hand in overseeing the welfare of the Eskimo, it may justly be said that prior to 1941 the actual numbers of the Canadian Eskimo population were not known, and so any statement concerning the increase or decrease in population cannot be based on completely valid facts. However, the known figures which indicate a slow increase are what might be expected with modern medical assistance and more efficient hunting weapons. The limitations in the natural environment of the Eastern Arctic prevent any rapid increase, since the region cannot support a large population under present game and food conditions. Regardless of how indications of past trends may be interpreted, a fairly accurate picture of the numbers and distribution of the Canadian Eastern Arctic Eskimo population is now available so that it can be watched with a critical eye in the future.

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